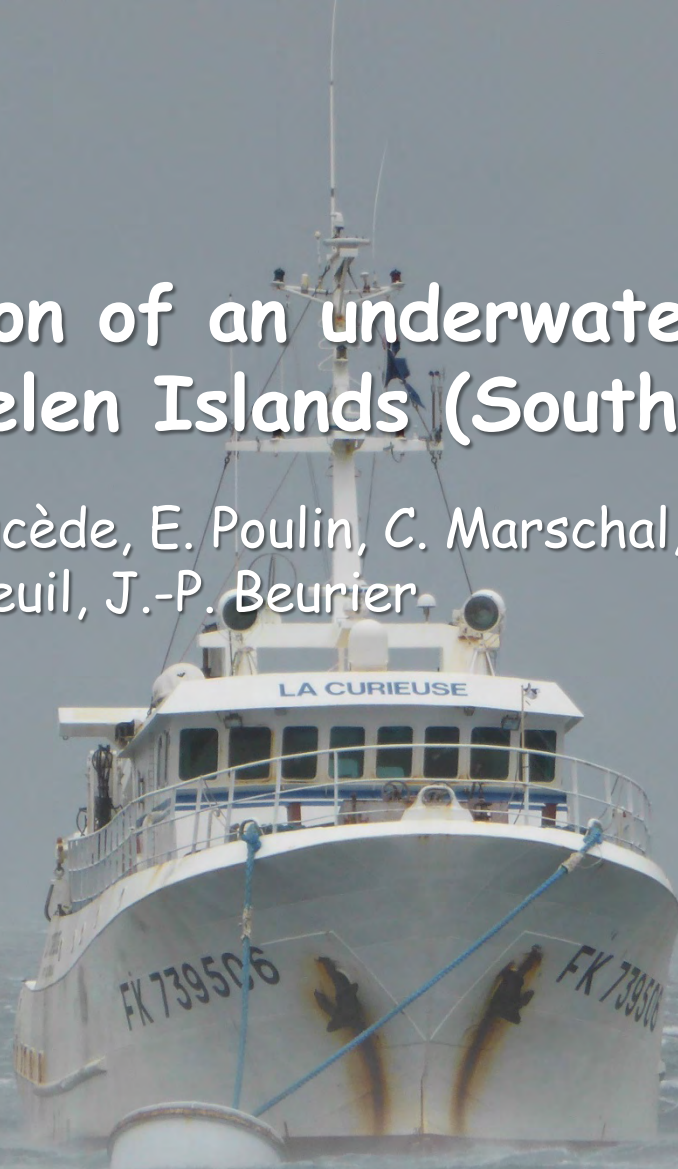
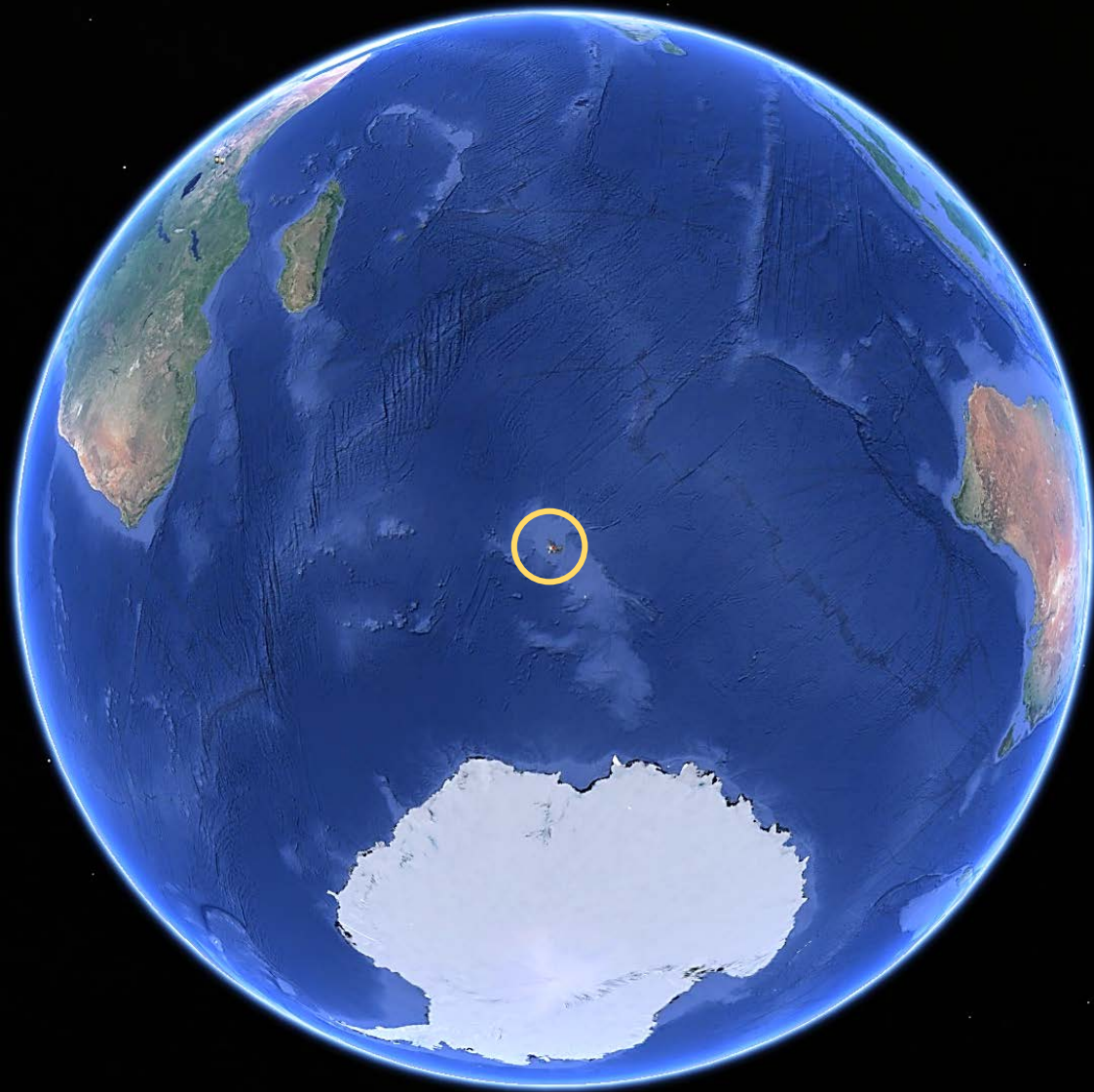


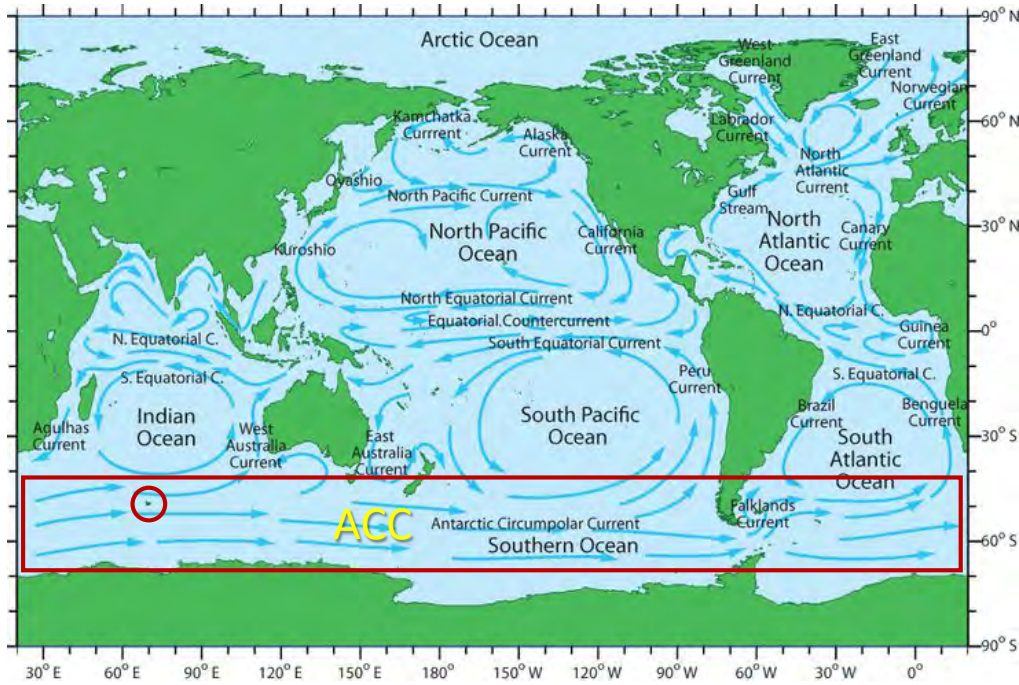


PROTEKER: Implementation of an underwater observatory at the Kerguelen Islands (Southern Ocean)

J.-P. Féral, T. Saucède, E. Poulin, C. Marschal, G. Marty,
J.-C. Roca, S. Motreuil, J.-P. Beurrier

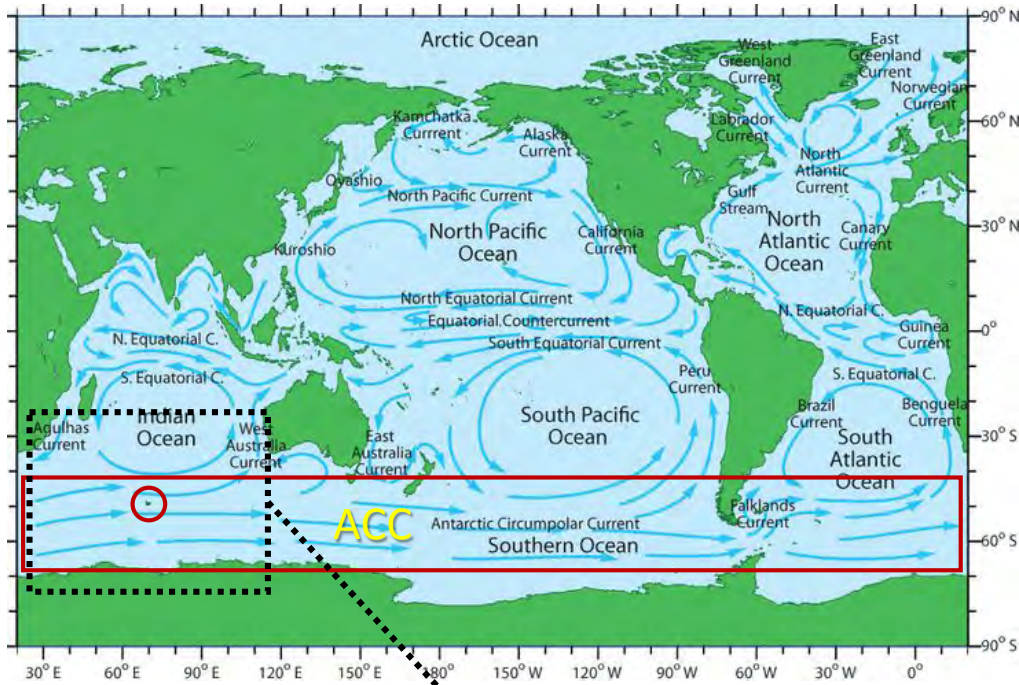






Antarctic Circumpolar Current

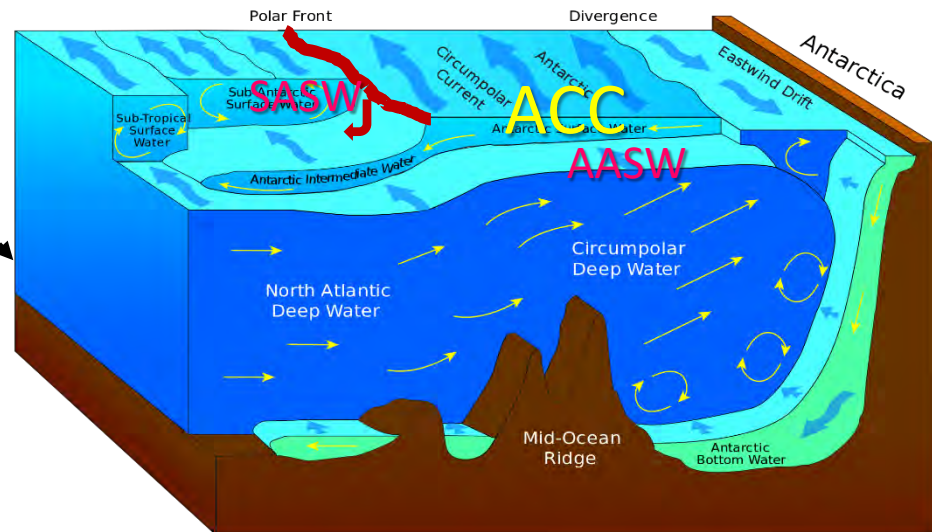
Kerguelen archipelago emerges in a very dynamic region



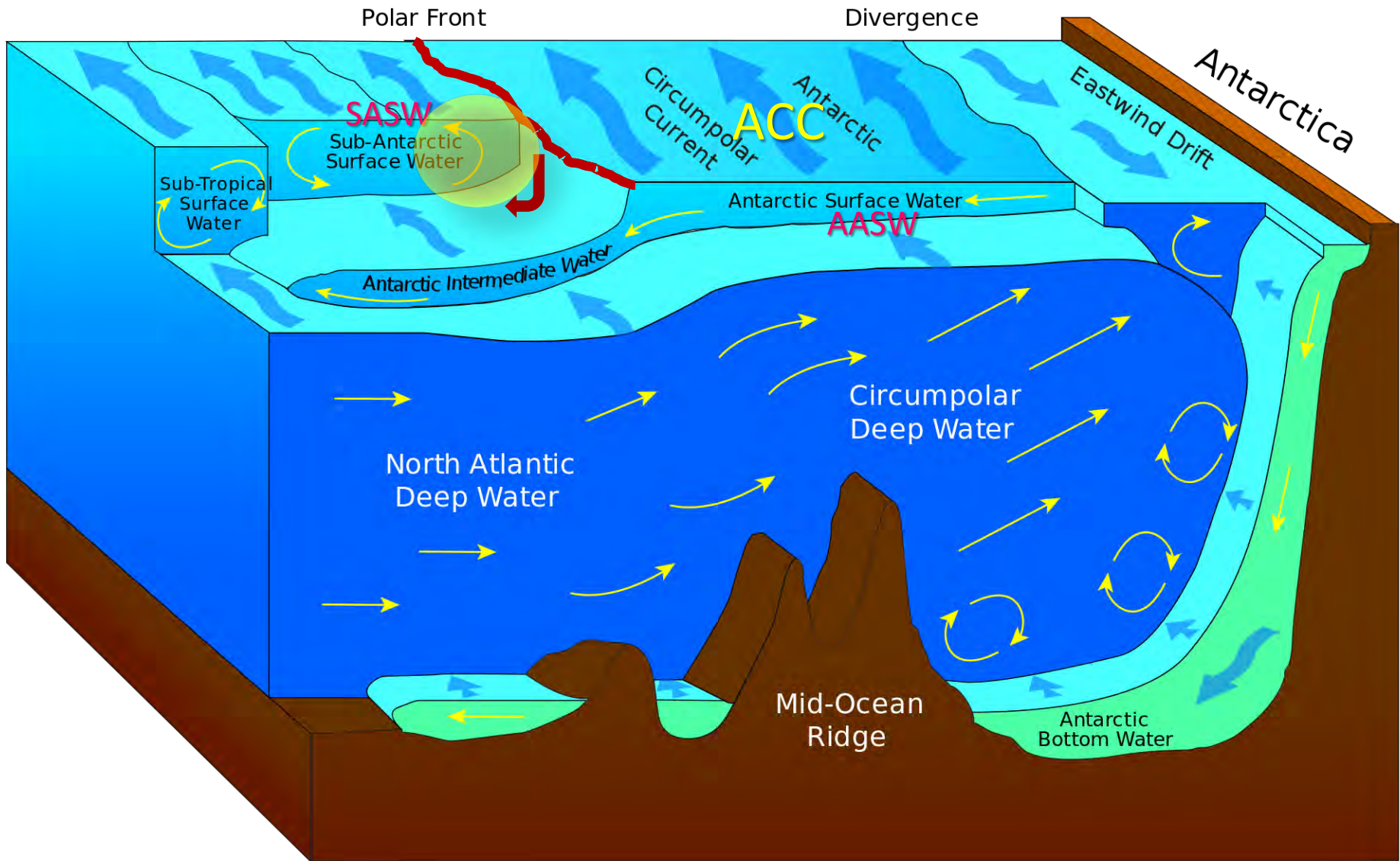
Kerguelen archipelago emerges in a very dynamic region

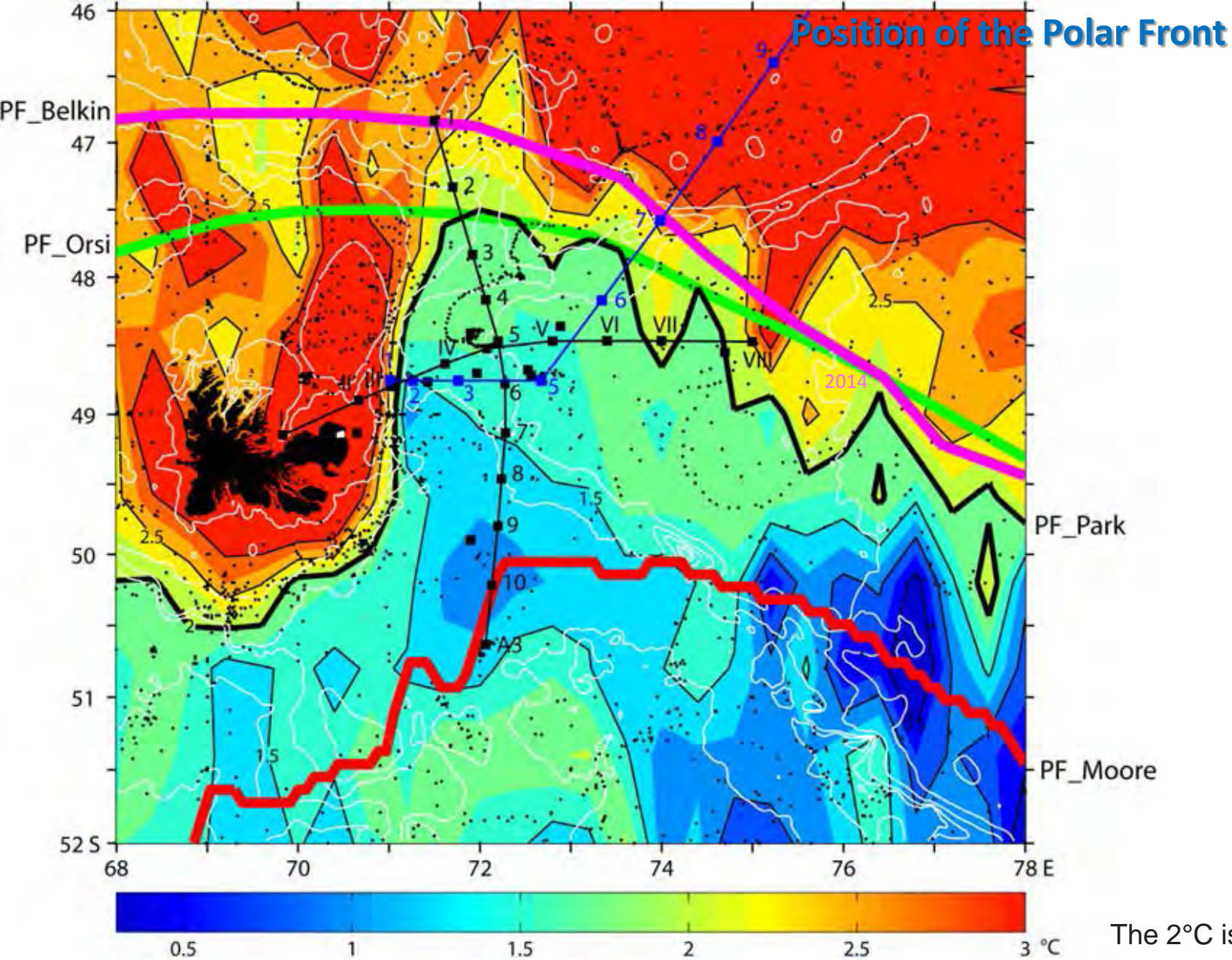
- In the flow of ACC
- At the confluence between several water masses AASW, PFSW and SASW
- Close to the Antarctic convergence (PF)

Subantarctic Surface Water (SASW)
 Polar Frontal Surface Water (PFSW)
 Antarctic Surface Water (AASW)

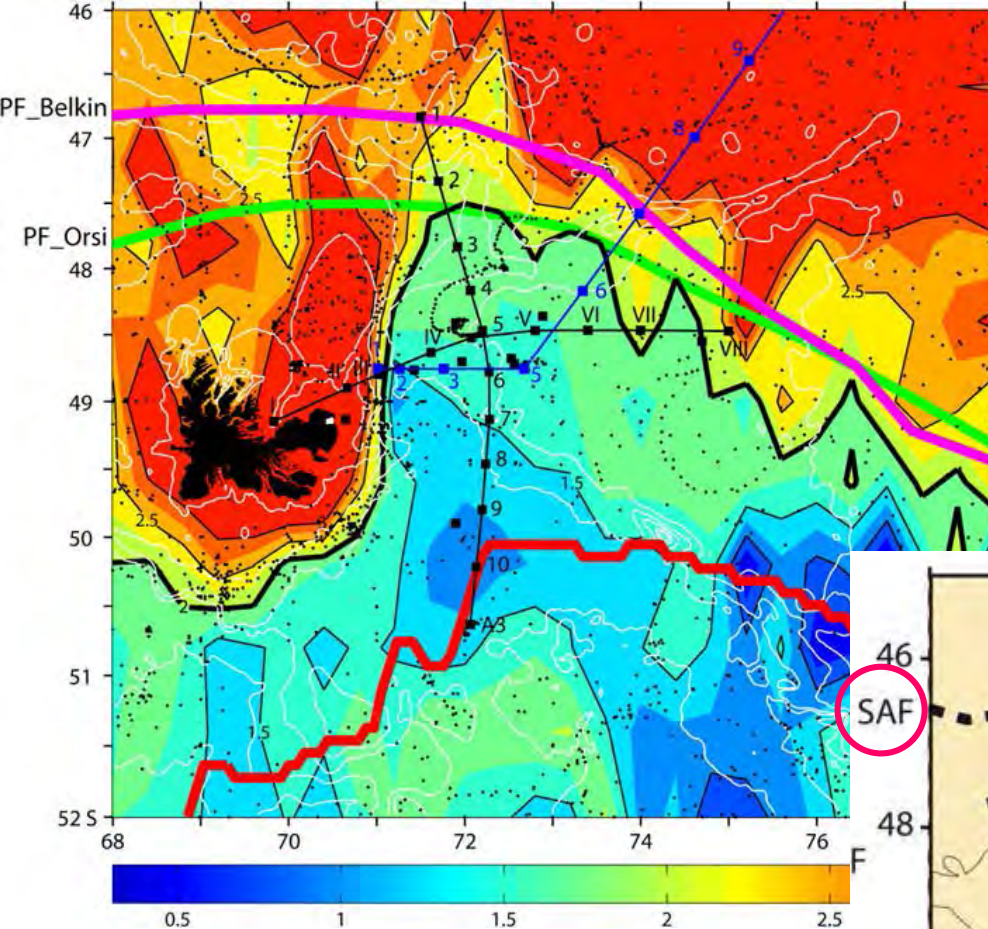


Austral Ocean's hydrologic fronts and water masses



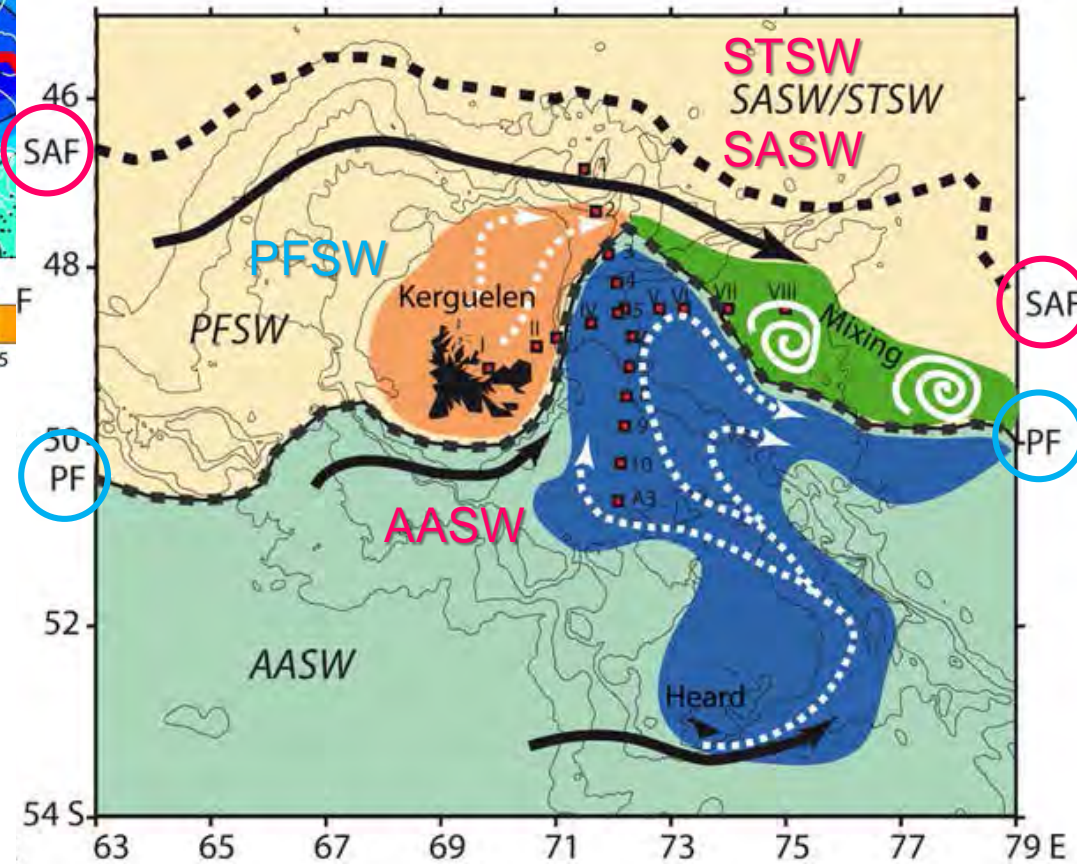


The 2°C isotherm corresponding to Park's PF (2014) is shown by a thick black line.



Position of the Polar Front

Kerguelen area is a major confluence where tropical and subtropical surface waters meet and interact with waters of Subantarctic and Antarctic origins



- Subtropical Surface Water (STSW)
- Subantarctic Surface Water (SASW)
- Polar Frontal Surface Water (PFSW)
- Antarctic Surface Water (AASW)

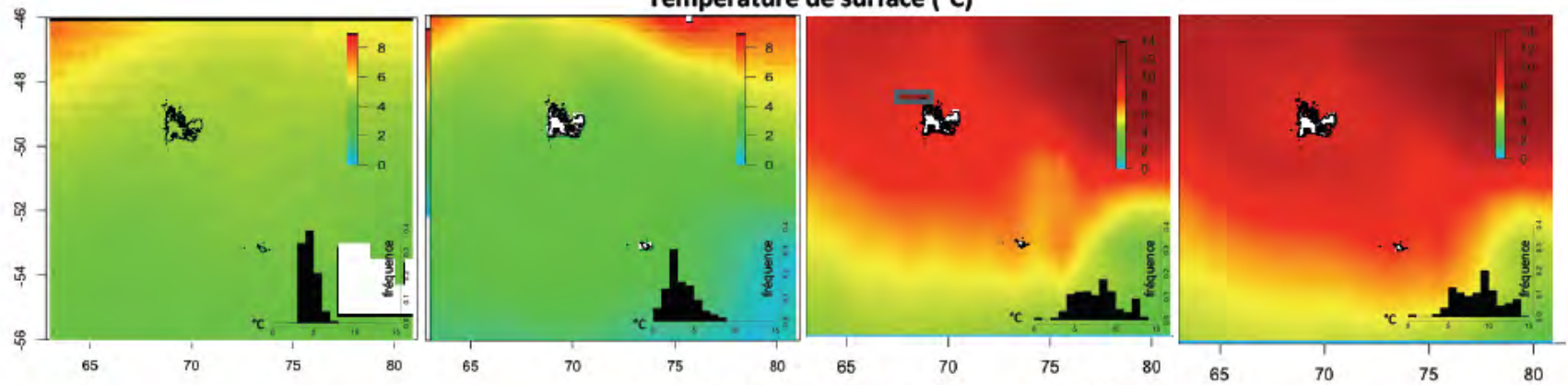
Température de surface (°C)



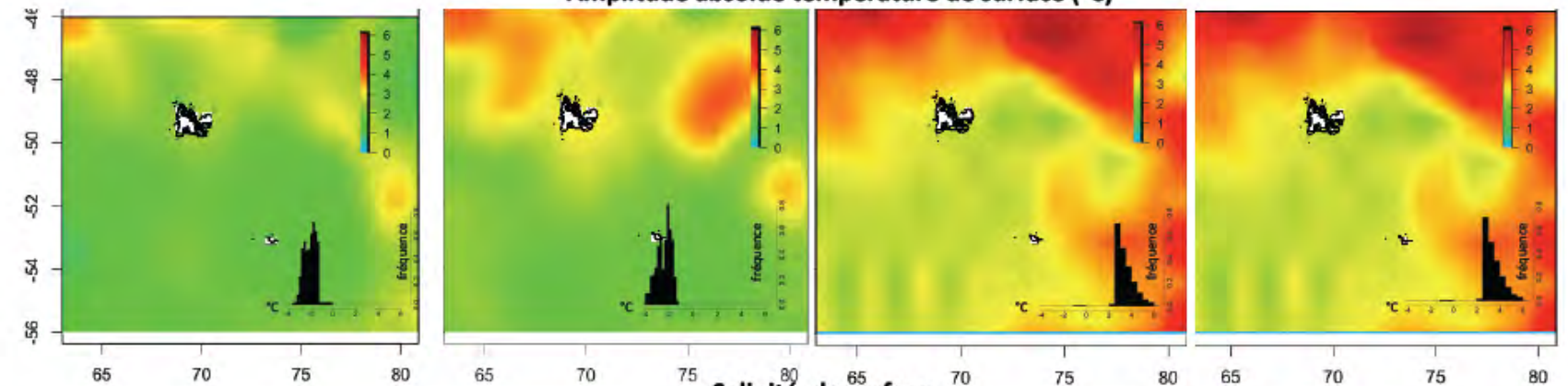
Visiting the [predictive] models ...



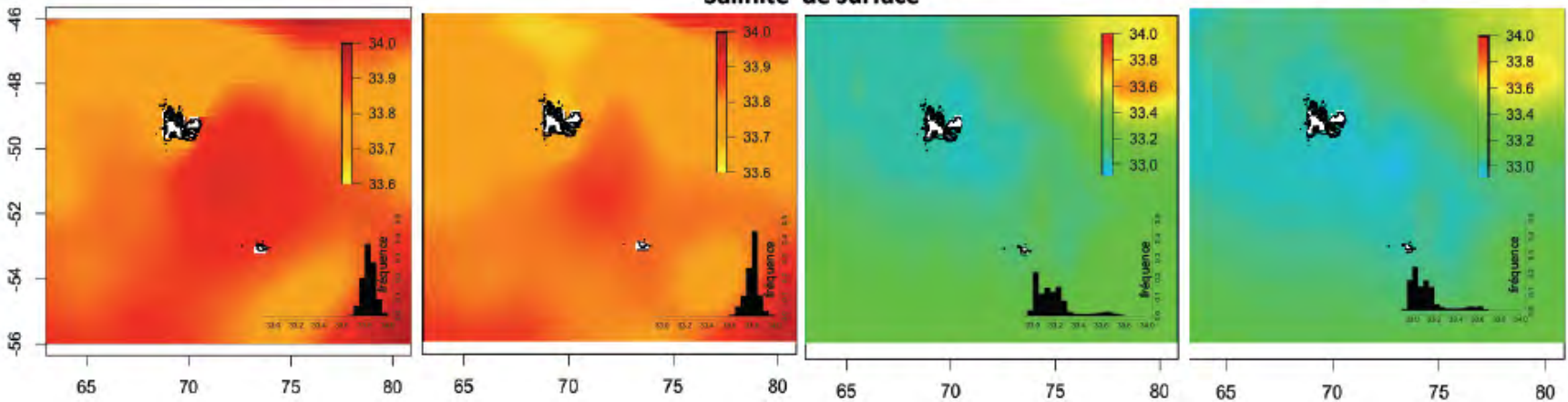
Température de surface (°C)

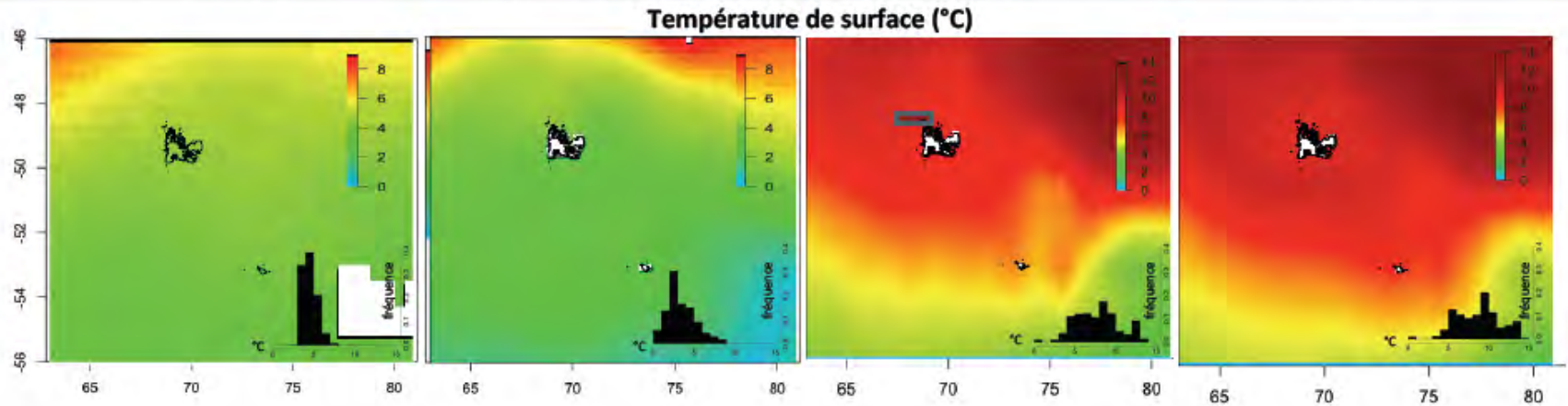


Amplitude absolue température de surface (°C)

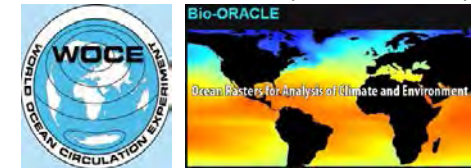


Salinité de surface





Maps drawn from data of WOCE (extent/old) and Bio-Oracle (future) in the framework of scenarios AIB (IPCC, 2007)



'Today' water masses shift

Doesn't take into account the south shift of the fronts (!) whose position is even not well defined ...

For 2100 and 2200, monthly mean temperature (SST, SAT) and average monthly mean salinity conditions over 10-year periods (2087–2096 and 2187–2196) were built with the R package “raster” (Hijmans and van Etten 2011). These grids represent environmental conditions at the end of the 21st and the 22nd century provided by the World Climate Research Programme Coupled Model Intercomparison Project (WCRP CMIP3) multi-model database (<http://esg.llnl.gov:8080/index.jsp>). This future scenario is based on A1B (720 ppm CO₂ stabilization) IPCC scenario represented by the UKMO-HadCM3 model.

Latitudinal shift of waters with other characteristics ($T^{\circ}\text{C}$, S°/oo , nutrients, ...)

→ environmental changes that may affect coastal biodiversity and ecosystem functioning.

Modern observations indicate that this highly dynamic region is already undergoing change in response to a warming climate.



KERQUELEN # Glacier Ampère # Baie de la Table
Hélène 2013

Ampère glacier has retreated 5 km in 30 yrs

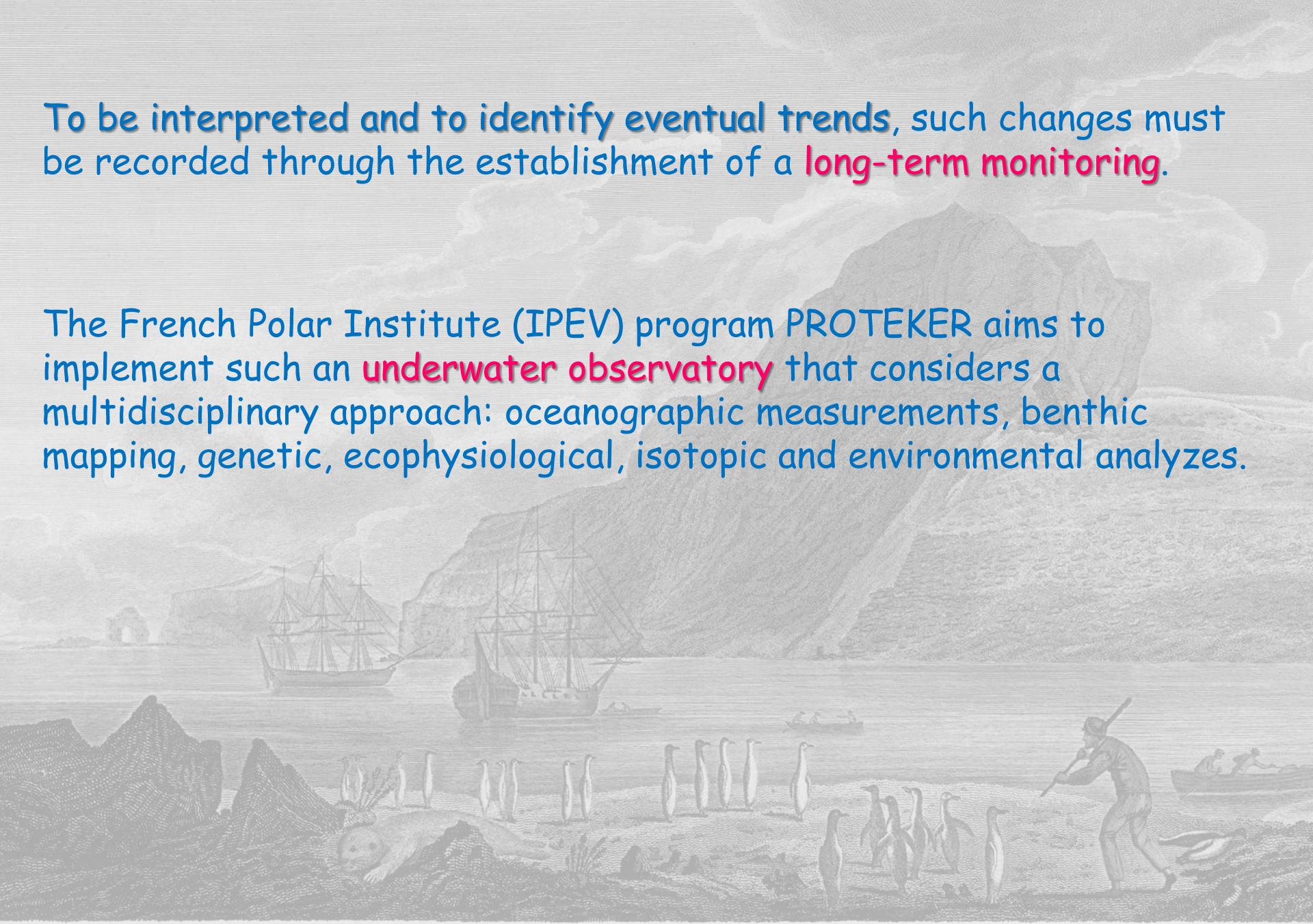
To be interpreted and to identify eventual trends, such changes must be recorded through the establishment of a **long-term monitoring**



A View of CHRISTMAS HARBOUR, in KERGUELEN'S LAND.

To be interpreted and to identify eventual trends, such changes must be recorded through the establishment of a **long-term monitoring**.

The French Polar Institute (IPEV) program PROTEKER aims to implement such an **underwater observatory** that considers a multidisciplinary approach: oceanographic measurements, benthic mapping, genetic, ecophysiological, isotopic and environmental analyzes.



A View of CHRISTMAS HARBOUR, in KERGUELEN'S LAND.

To be interpreted and to identify eventual trends, such changes must be recorded through the establishment of a **long-term monitoring**.

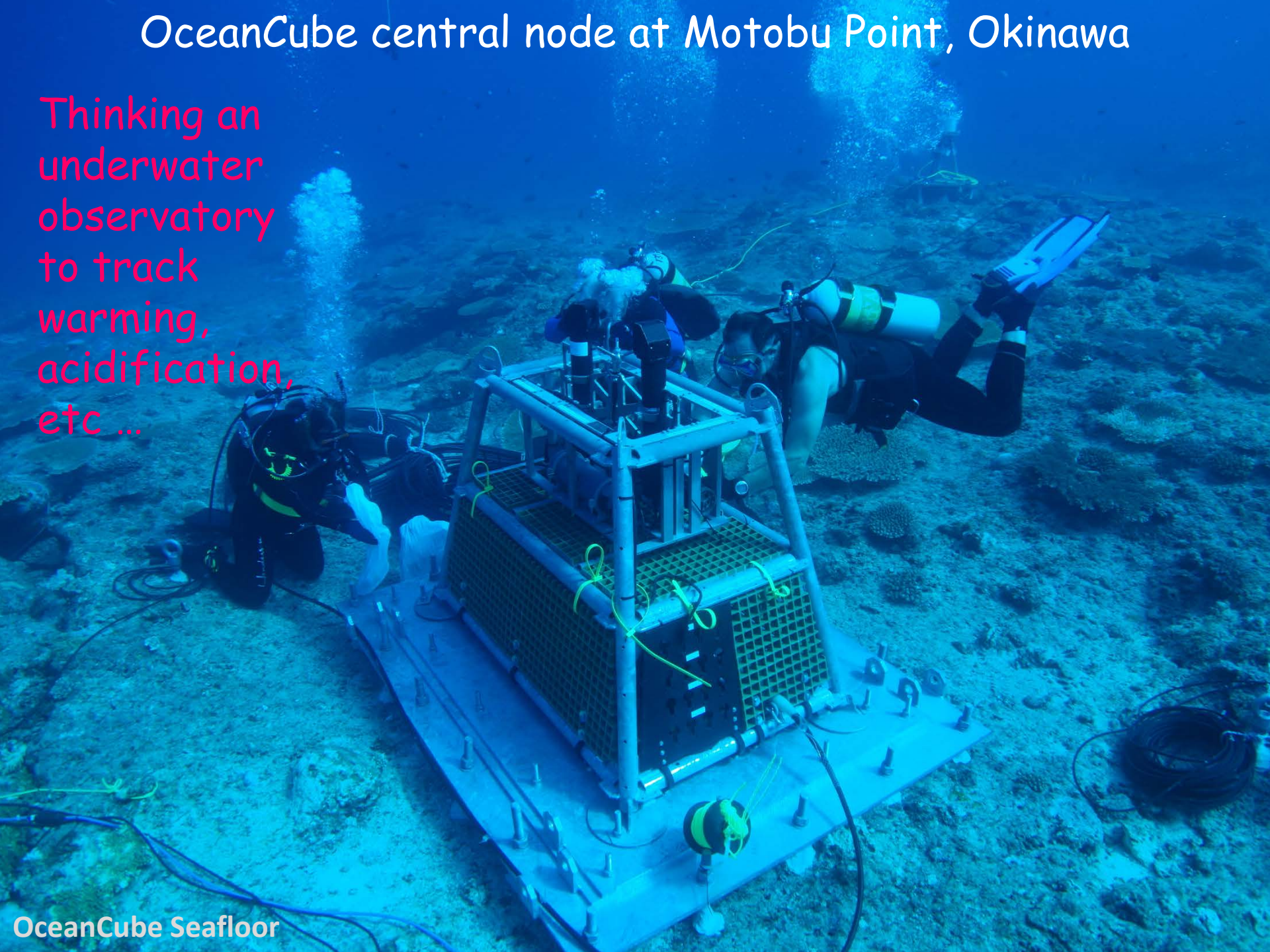
The French Polar Institute (IPEV) program PROTEKER aims to implement such an **underwater observatory** that considers a multidisciplinary approach: oceanographic measurements, benthic mapping, genetic, ecophysiological, isotopic and environmental analyzes.

In addition to the inventory and the monitoring of biodiversity, it also aims at providing **scientific criteria** to managers in charge of **protection and conservation policies** (French Southern Lands National Nature Reserve).

Thinking an
underwater
observatory
to track
warming,
acidification,
etc ...

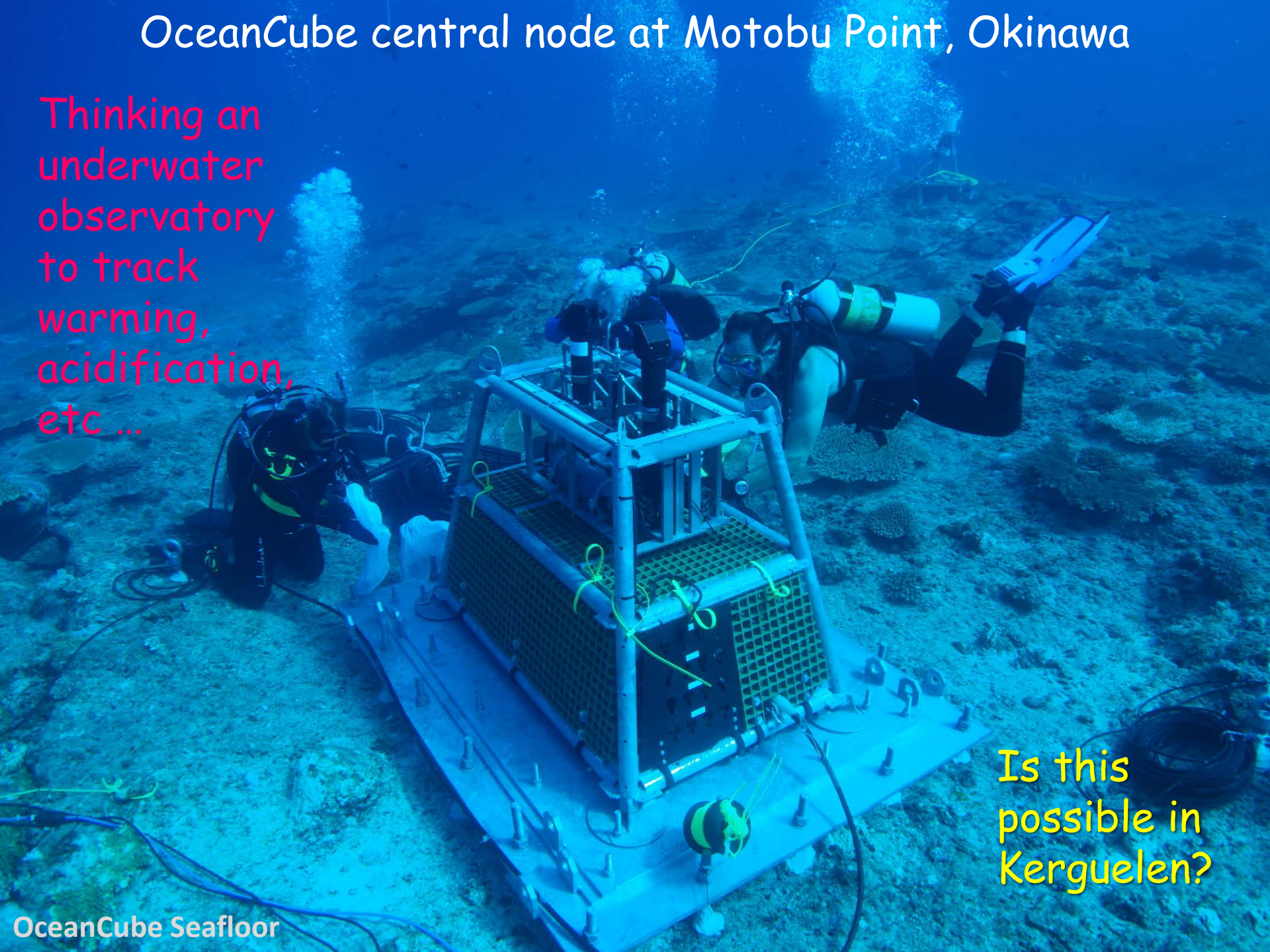
OceanCube central node at Motobu Point, Okinawa

Thinking an
underwater
observatory
to track
warming,
acidification,
etc ...



OceanCube central node at Motobu Point, Okinawa

Thinking an
underwater
observatory
to track
warming,
acidification,
etc ...



Is this
possible in
Kerguelen?

There is a need to adapt practices to local conditions and circumstances

Between the *roaring forties* and the *furious fifties*

- weather and sea often harsh
- accessibility can be tough, risk of loss and degradation of gear
- implemented gear must be highly resistant, as inexpensive as possible, able of several years of functioning

Support vessel not always available

- possible gap in the observations and measurements
- great autonomy

Little / insufficient funding

- looking for "low cost"
- limited number of staff
- survey at sea difficult since it depends on a supporting vessel

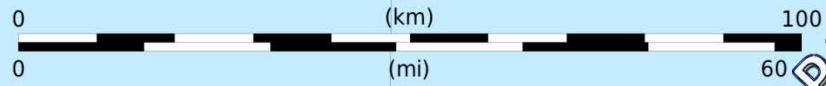


The return of *La curieuse* to Kerguelen for summer campaigns

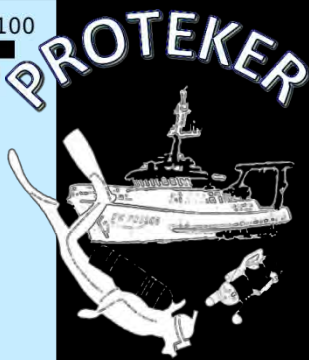
→ PROTEKER (2011-2014)
phase 1

➤ To choose relevant sites





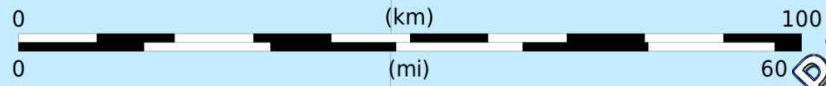
Projection UTM - WGS84 datum



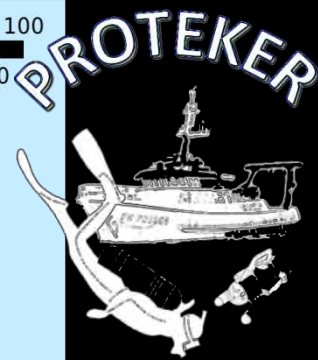
PROTEKER 2011

- Campagne Nord
- Campagne Morbihan, Norvégienne
- Campagne Sud
- Côte ouest / Ile de l'Ouest

planed



Projection UTM - WGS84 datum



PROTEKER 2011

- Campagne Nord
- Campagne Morbihan
- Campagne Sud

done



implemented techniques

Beam Trawl



PROTEKER 2-27/ 11/2013
Station : Xmas
Latitude Sud :
Longitude Est :
Profondeur (m) 100
Gaste 20/20/20
3
Coll. J.P. Feral, C. Marschal, G. Marty,
E. Poitou, T. Saucède

Provoicator pulcher

Beam Trawl



Provocator pulcher

Remotely Operated Vehicle
ROV



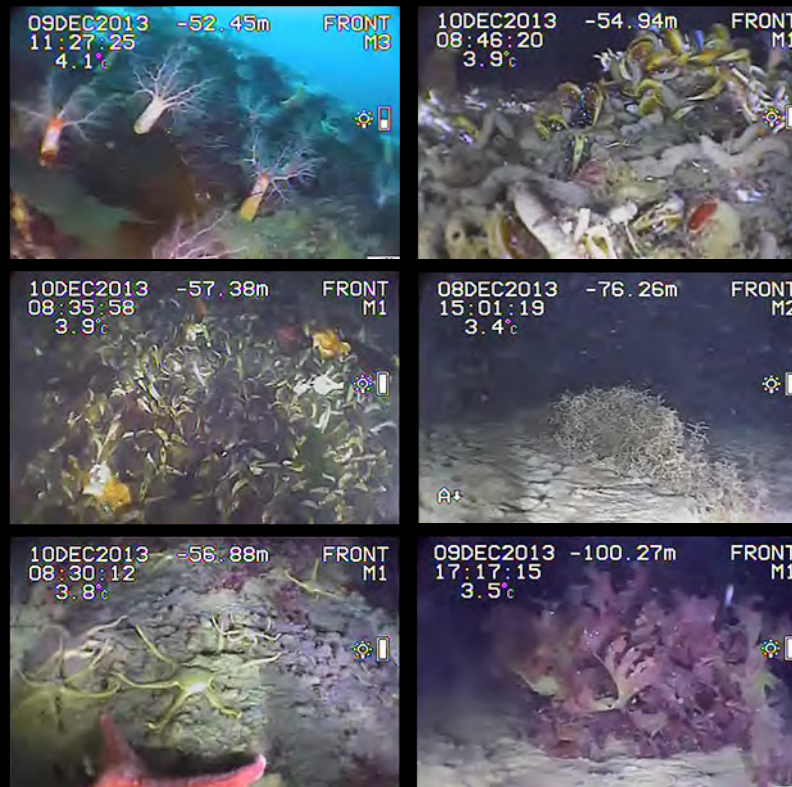
Beam Trawl



PROTEKER 2-27/ 11/2013
 Station : Xmas
 Latitude Sud :
 Longitude Est :
 Profondeur (m) : 100
 Gasteropode (3)
 Coll. J.P. Feral, C. Marschal, G. Marty,
 E. Poëlle, T. Saucède

Provoconator pulcher

Remotely Operated Vehicle ROV

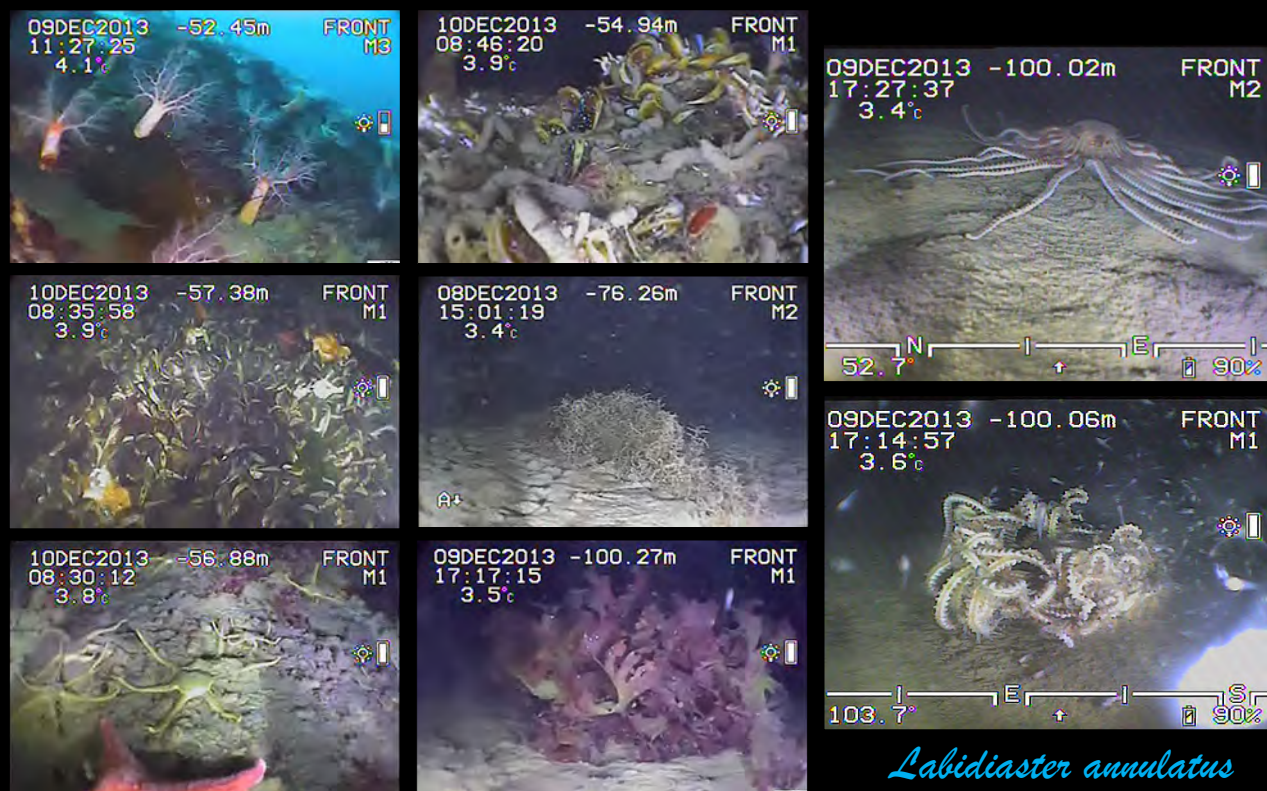


Beam Trawl

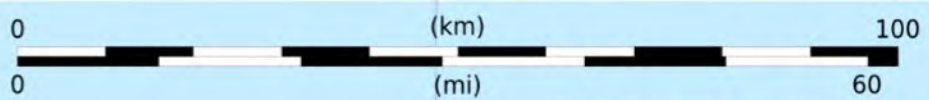


Provoctator pulcher

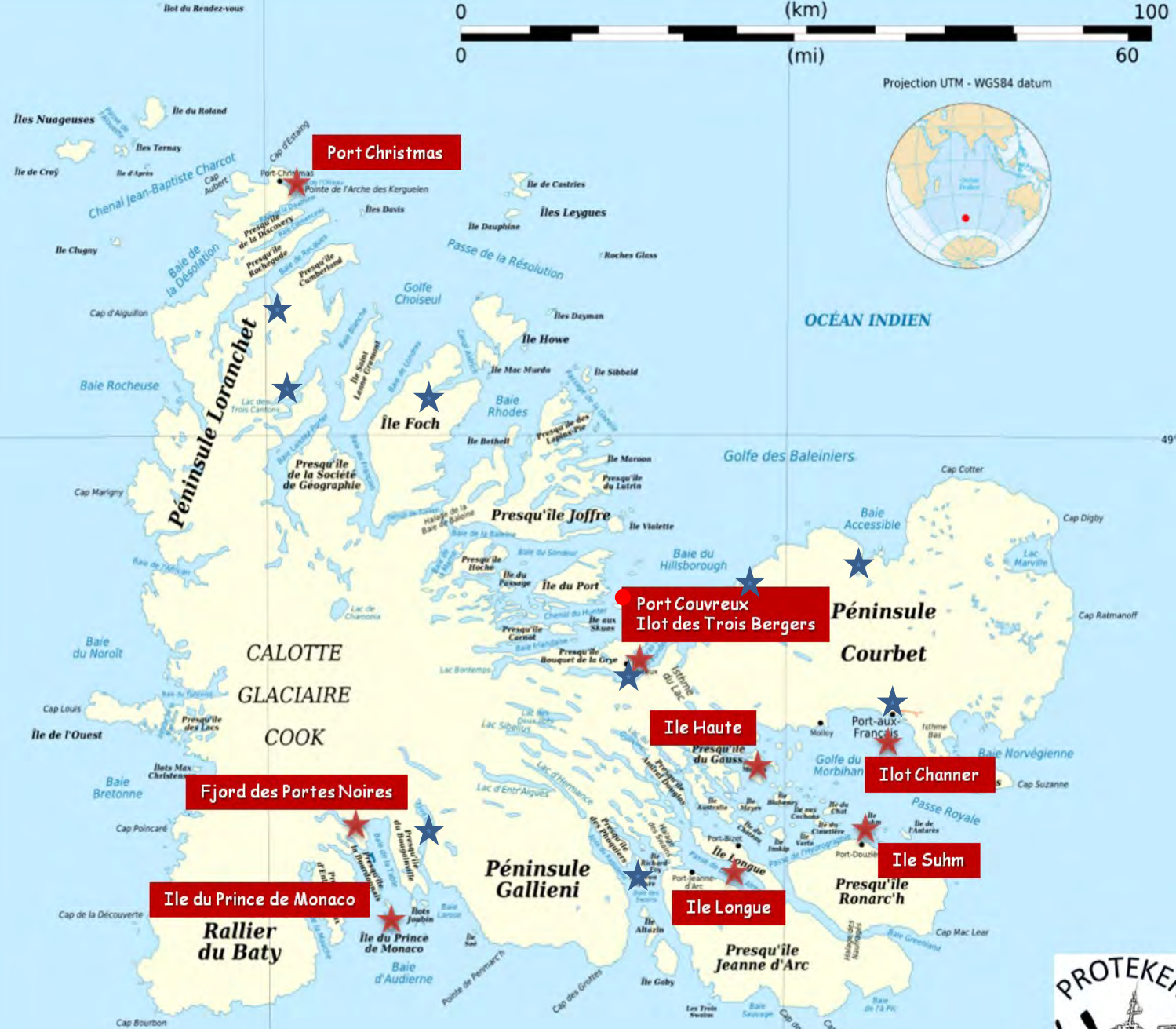
Remotely Operated Vehicle ROV



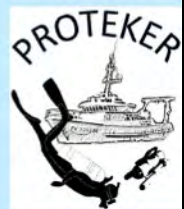
Labidiaster annulatus



Projection UTM - WGS84 datum



KERGUELEN monitored sites



Z = 5m

49°23'14,7" S

69°56'28,6" E

Photographs and GPS coordinates at each site

Ile Haute, thermoenregistreur 5m

Au pied de la paroi



Ile Haute

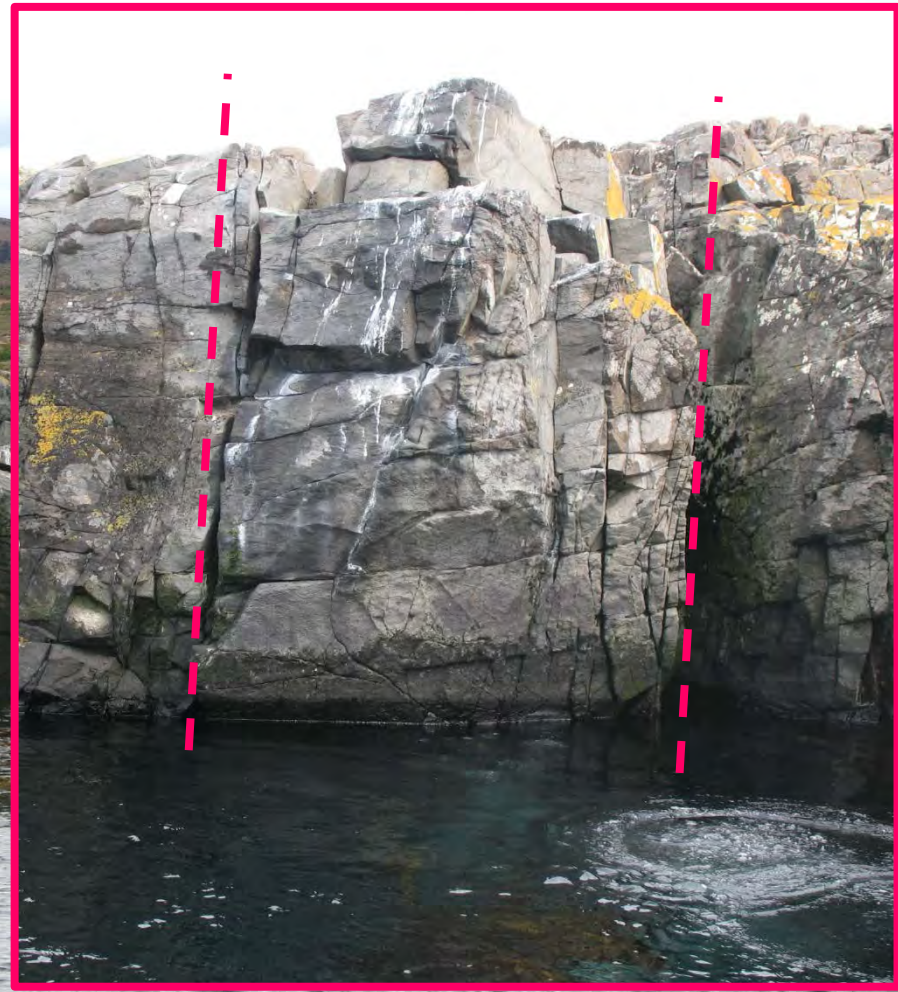
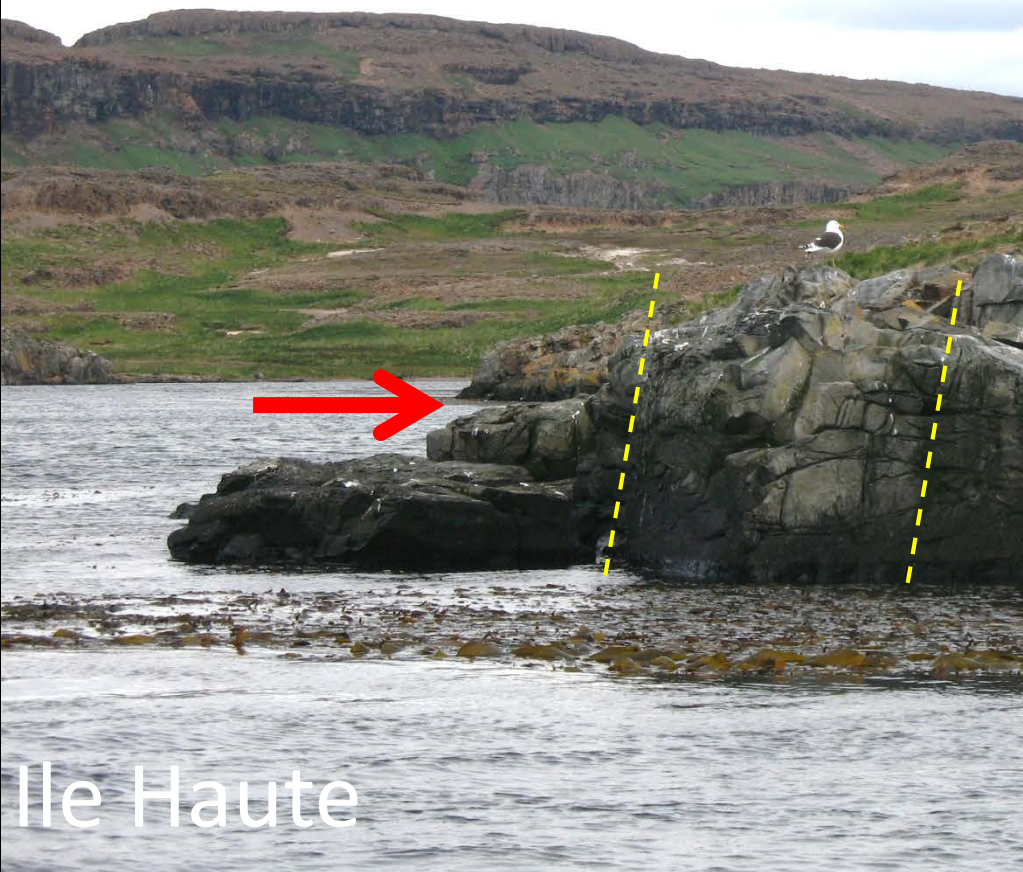
Z = 5m

49°23'14,7" S

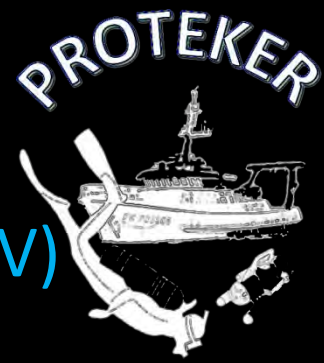
69°56'28,6" E

Photographs and GPS coordinates at each site

Ile Haute, thermoenregistreur 5m
Au pied de la paroi



Ile Haute



- To choose relevant sites
- To upgrade inventories (diving, towed gears, ROV)
 - guides (photos, video)
 - illustrated data bases (indexing, cataloguing, inter-operability, contextualization, traceability , international systems)

Shots / photographs & video



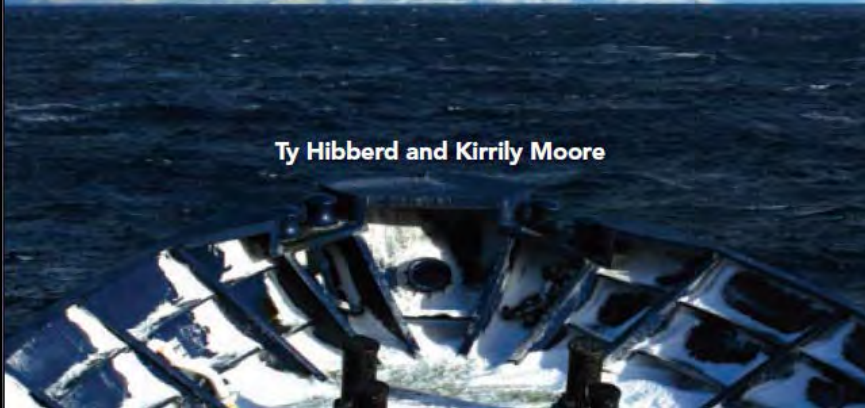
Field Identification Guide to Heard Island and McDonald Islands Benthic Invertebrates



A guide for scientific observers aboard fishing vessels



Ty Hibberd and Kirrily Moore



Pictorial guide to common HIMI taxa

Odontaster meridionalis



Five short arms with a mesh-like aboral surface.

Porania antarctica



Five armed orange/yellow coloured seastar with a mottled dorsal surface and soft, mucus covered oral surface. Marginal edge covered in conspicuous flattened spines.

Smilasterias triremis



Small, five arms, red/orange, tough, often arms missing. Four rows of suckered tube feet.

Tremaster mirabilis (cushion star)



Photograph by Karyn O'Brien
'Umbrella' shaped body with scaly surface.

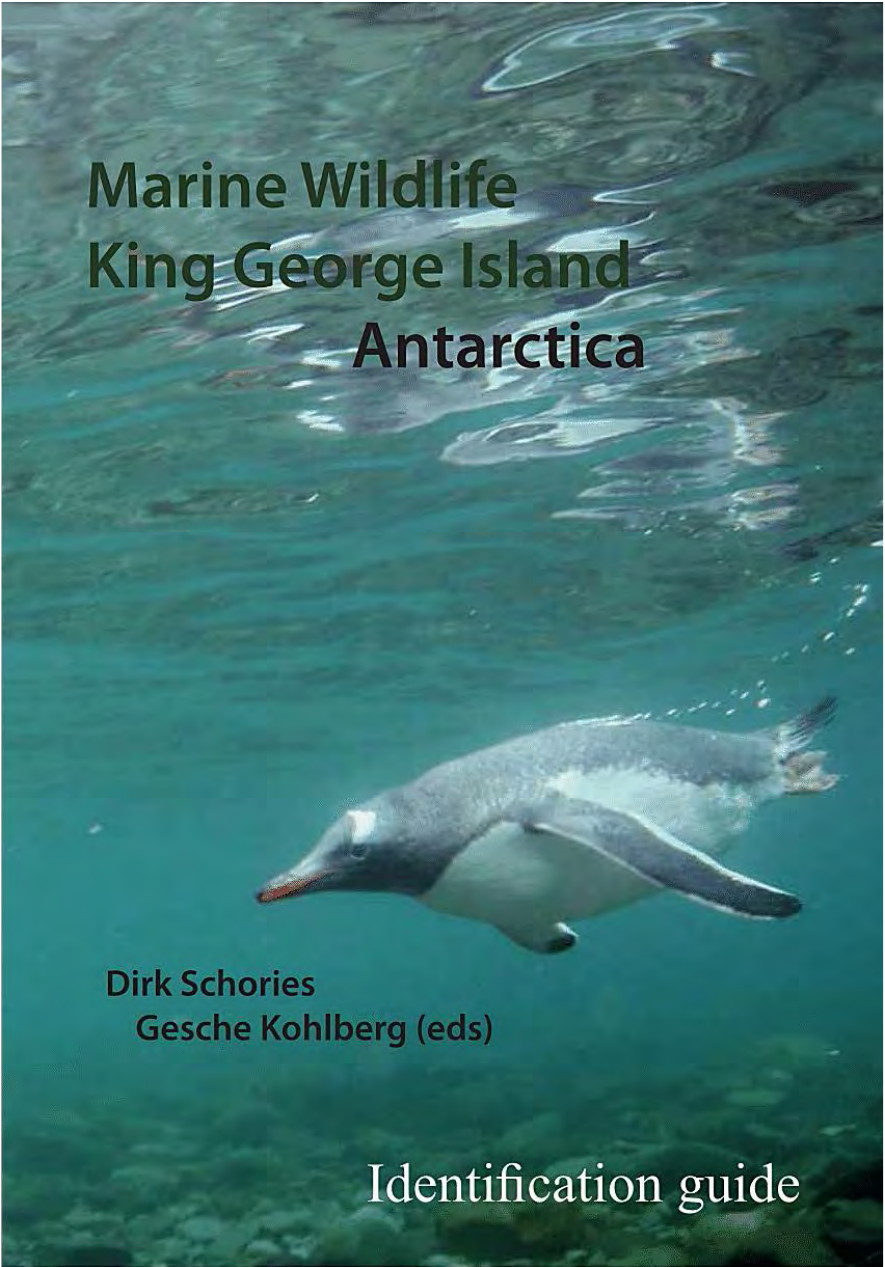
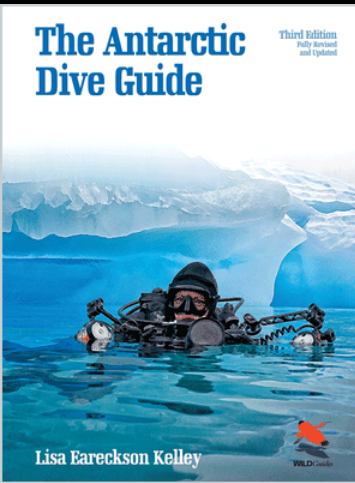
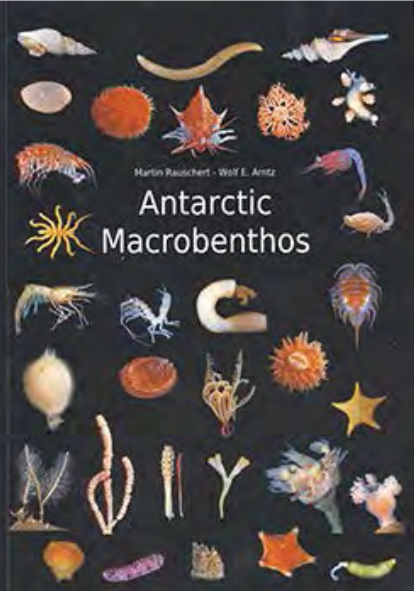




Under Antarctic Ice

THE PHOTOGRAPHS OF NORBERT WU

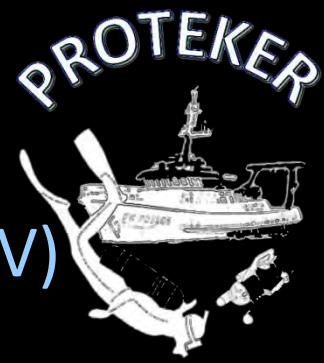
WITH TEXT BY JIM MASTRO AND PHOTOGRAPHIC NOTES BY NORBERT WU



Marine Wildlife King George Island Antarctica

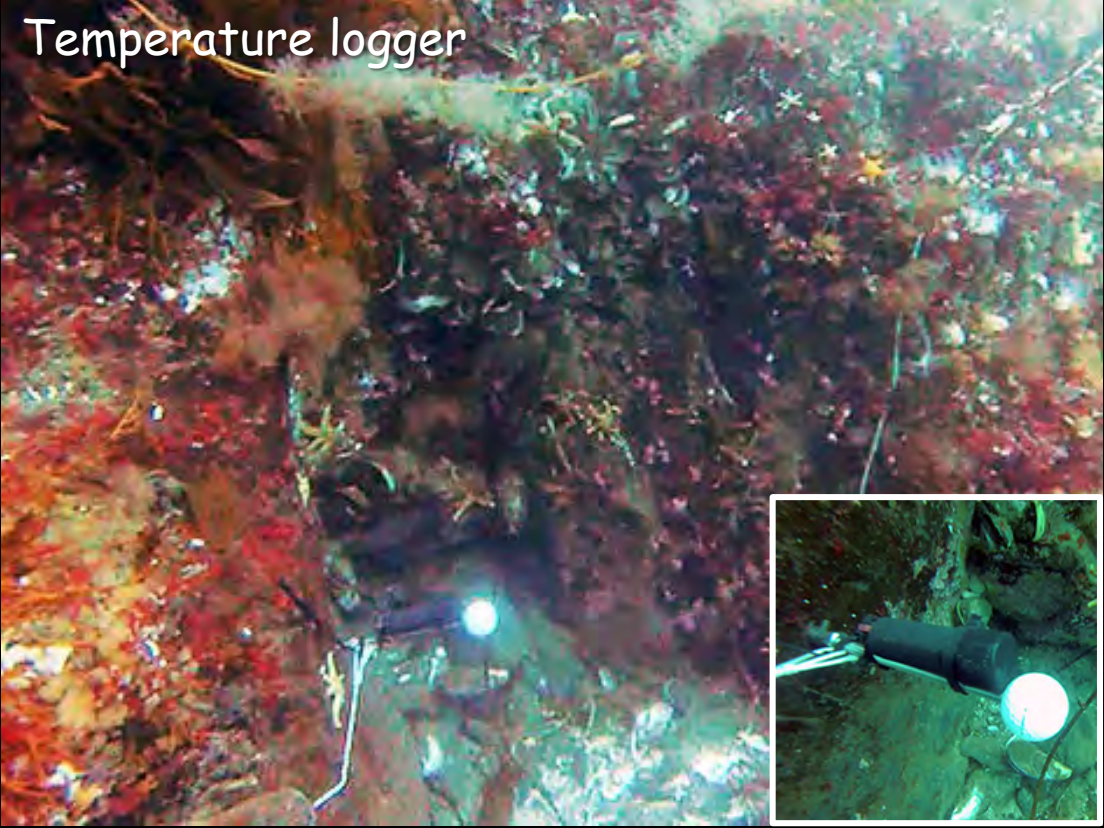
Dirk Schories
Gesche Kohlberg (eds)

Identification guide

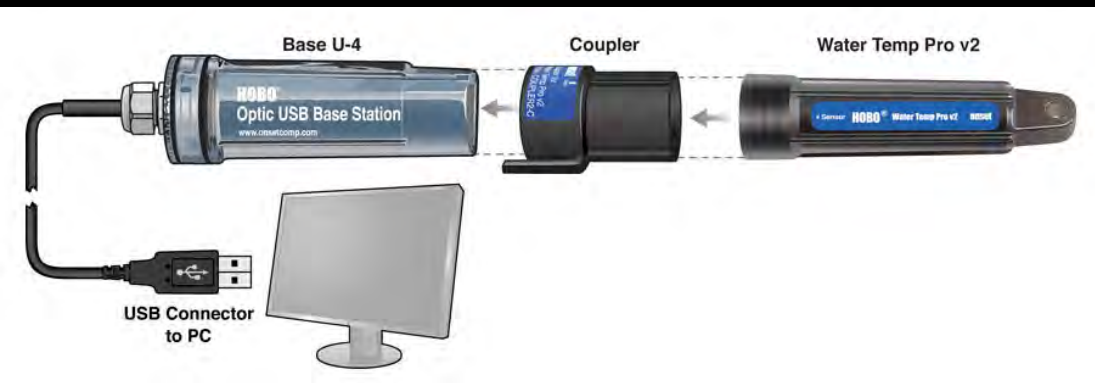
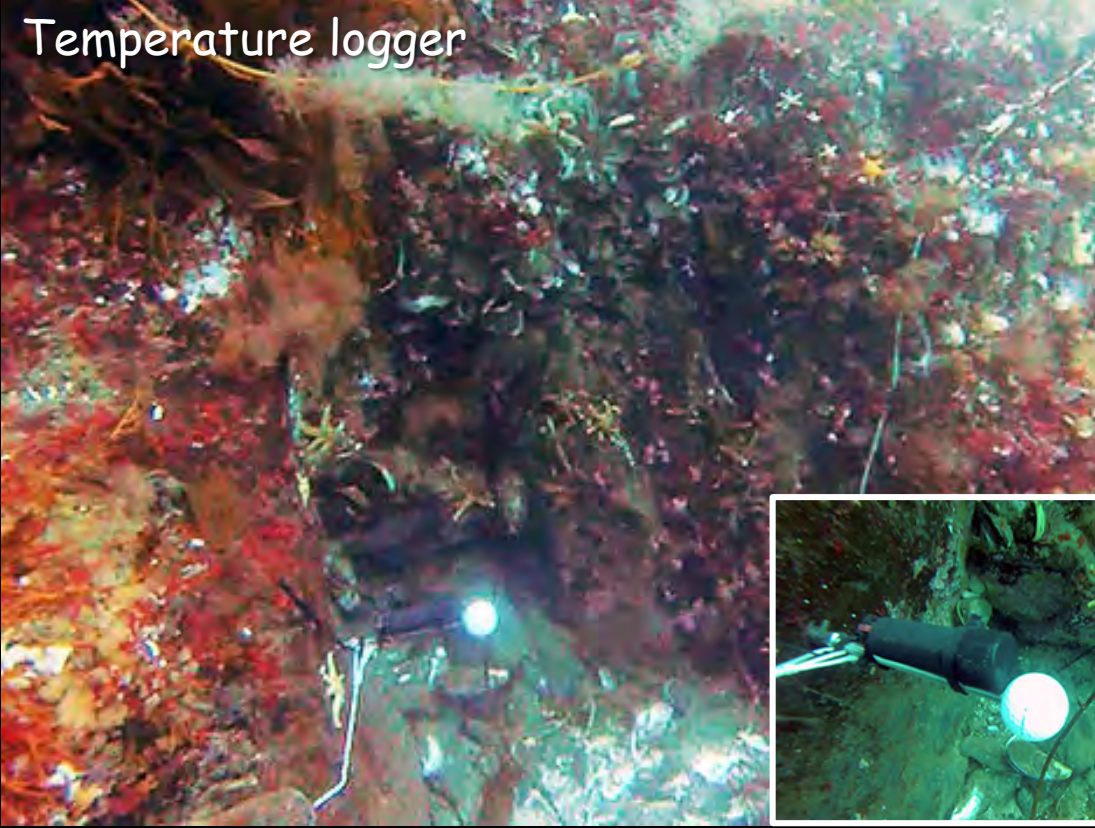


- To choose relevant sites
- To upgrade inventories (diving, towed gears, ROV)
 - guides (photos, video)
 - illustrated data bases (indexing, cataloguing, inter-operability, contextualization, traceability , international systems)
- To setup sensors
- To estimate speed and quality of colonisation / recruitment (settlement plots)

Temperature logger

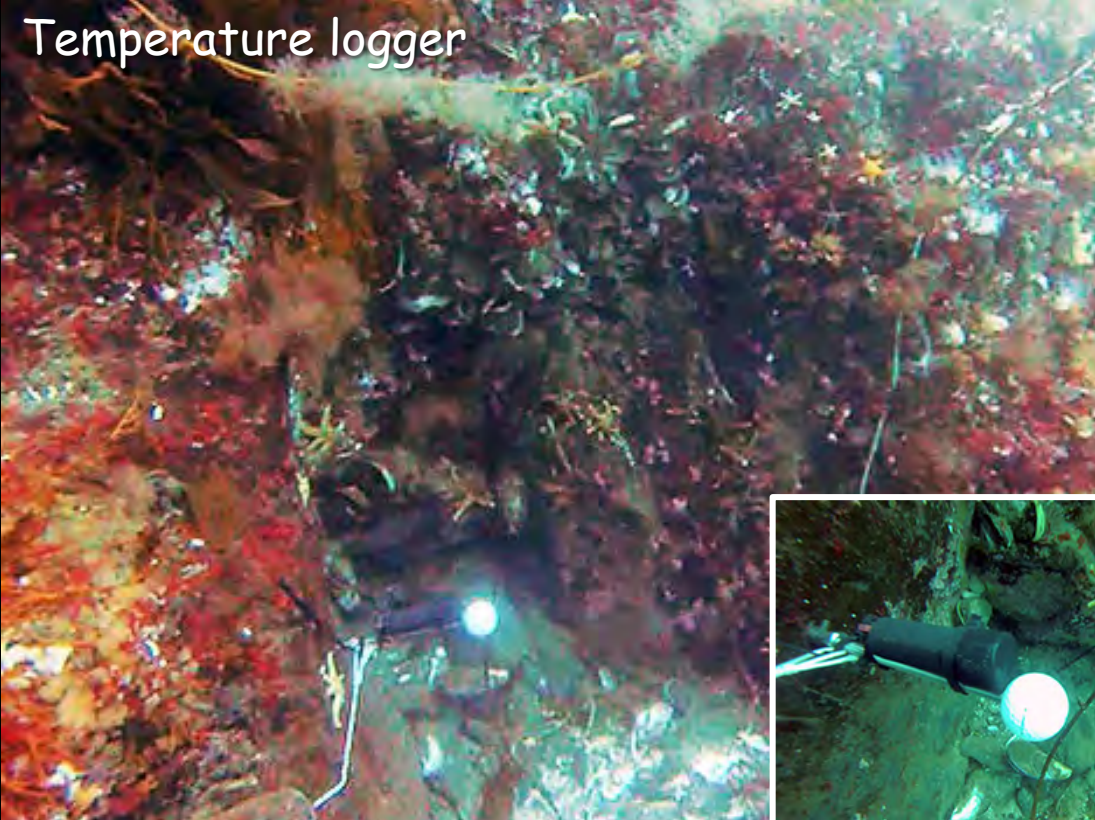


Temperature logger

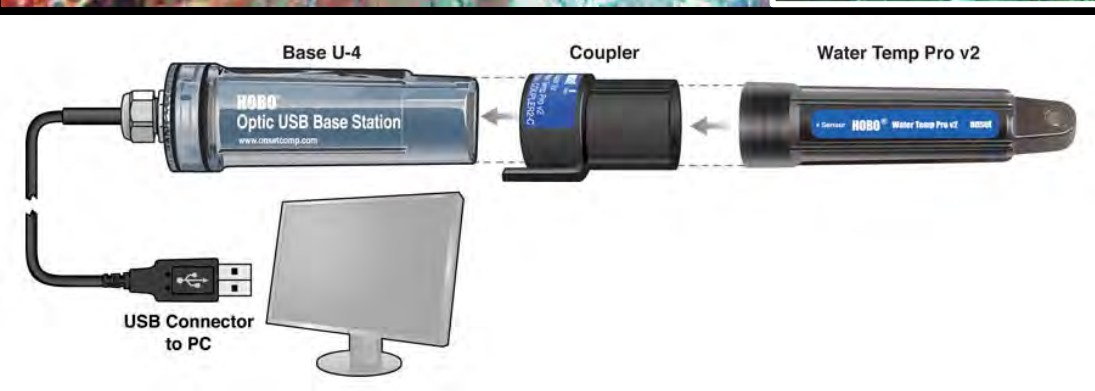


-20 °C to +50 °C in water / waterproof to 120 m /
Accuracy: $\pm 0.21^{\circ}\text{C}$ over 0 to 50°C / 42000
measurements / logging intervals: 1 second to 18
hours, fixed / drift: 0.1°C per yr

Temperature logger



Settlement plots



-20 °C to +50 °C in water / waterproof to 120 m /
Accuracy: $\pm 0.21^{\circ}\text{C}$ over 0 to 50°C / 42000
measurements / logging intervals: 1 second to 18
hours, fixed / drift: 0.1°C per yr

Temperature loggers



T°C

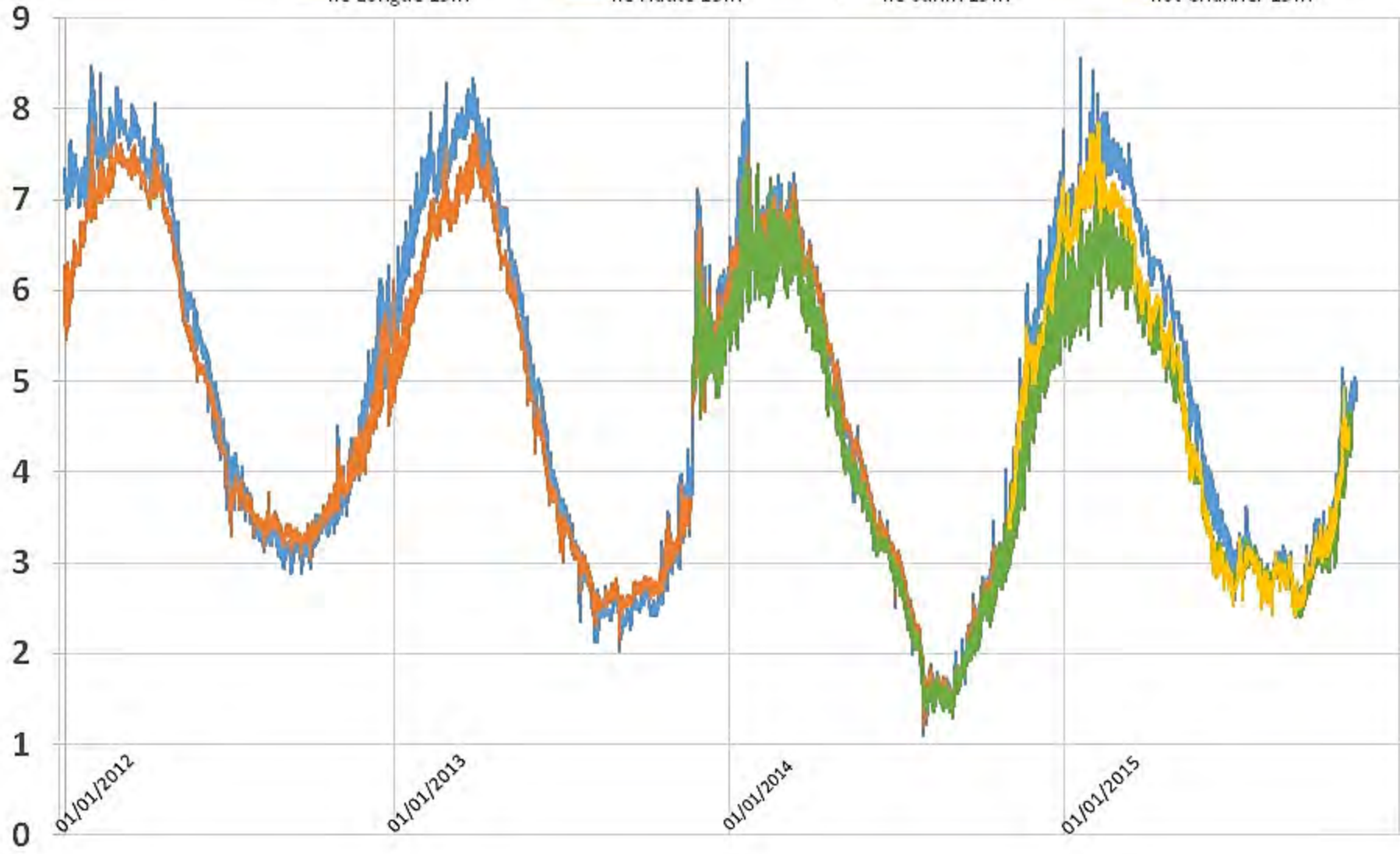
Sea water temperature in the Baie du Morbihan at 15m depth , 2012-2015

Ile Longue 15m

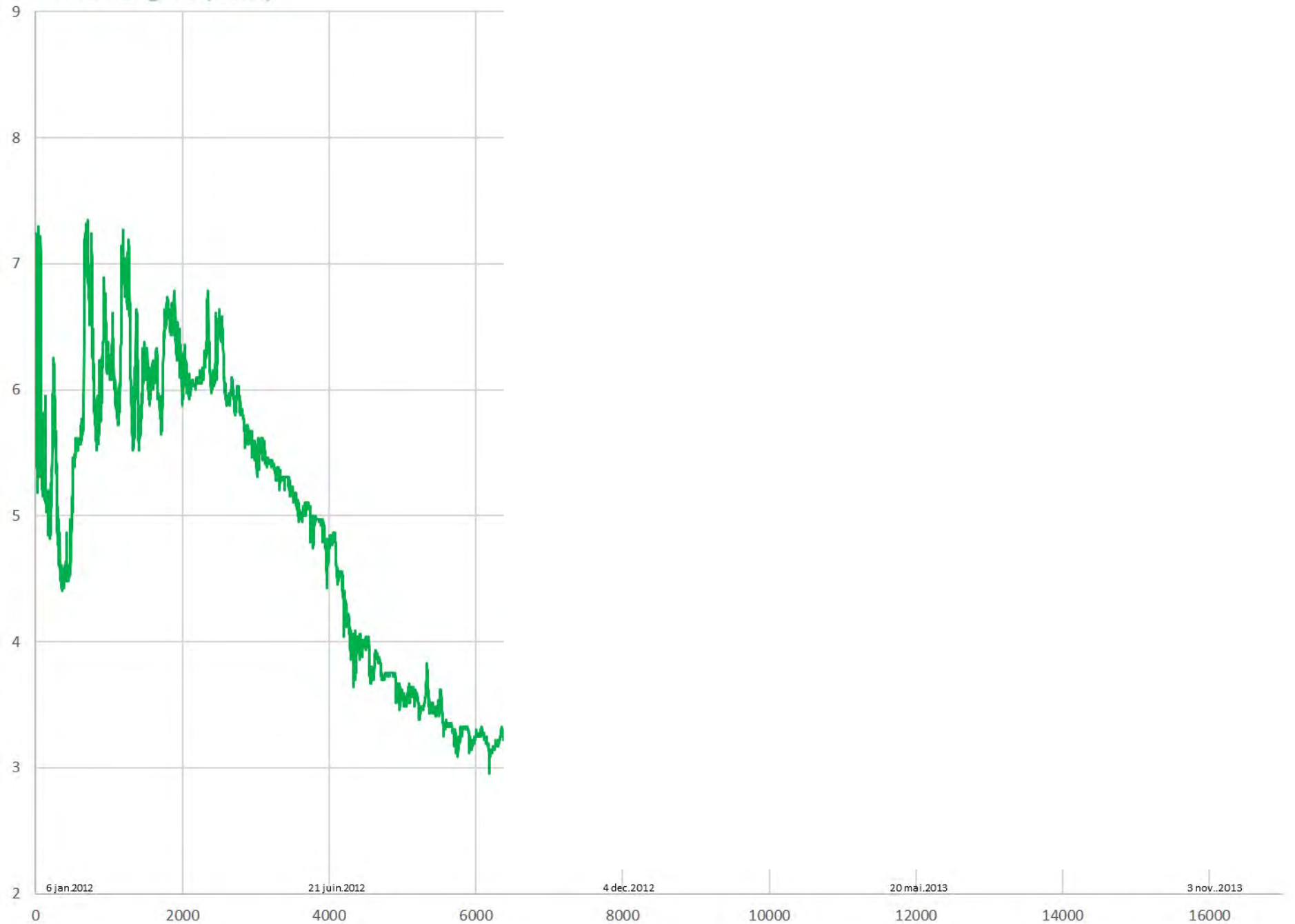
Ile Haute 15m

Ile Suhm 15m

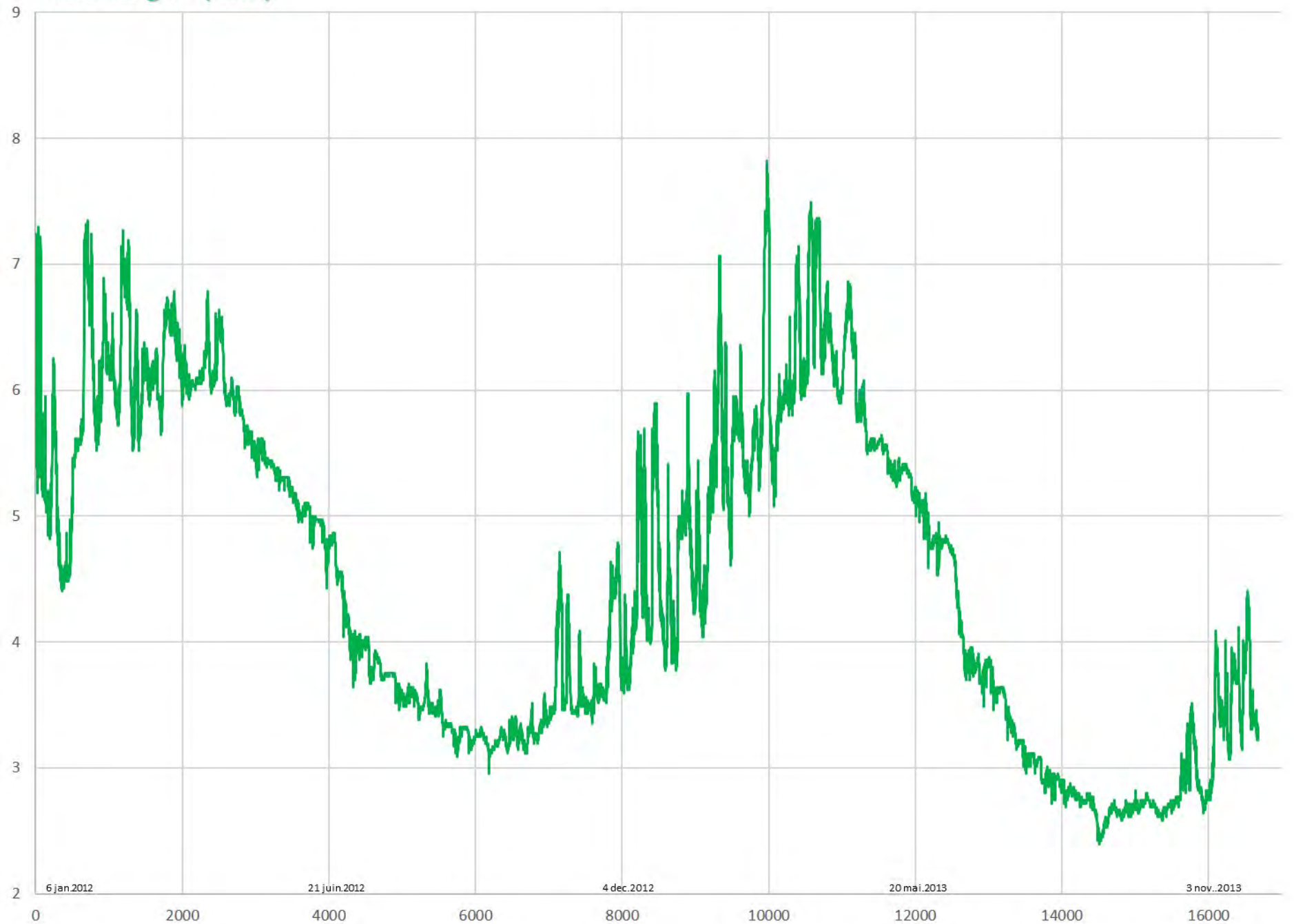
Ilot Channer 15m



Trois Bergers (15m)



Trois Bergers (15m)





[Proteker sites](#)

[Campaign 2011-12](#)

[Campaign 2013](#)

[Campaign 2014](#)

[Campaign 2015](#)

[Home page](#) > [Thermorecorders](#) > [Temperature monitoring, Ilot des Trois Bergers, Port Couvreur - Baleiniers sector](#)

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- [Partners and participants](#)
- [Observation sites](#)
- [Thermorecorders](#) ▶
- [Colonization plates](#)
- [What's up?](#)
- [Amsterdam](#)
- [Gallery](#)

- [Site Map](#)
- [Contact](#)
- [Member's logout](#)
- [Private area](#)

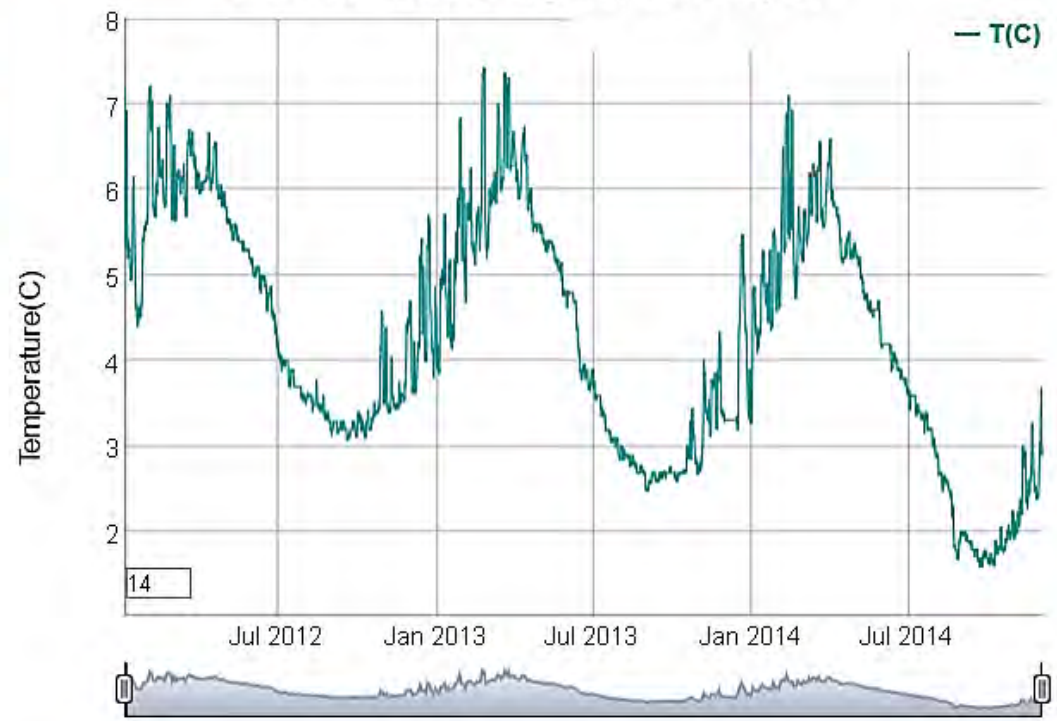
Jean-Pierre FERAL

Temperature monitoring, Ilot des Trois Bergers, Port Couvreur - Baleiniers sector

[Ilot des Trois Bergers 5m]					
[Ilot des Trois Bergers 15m]	2012	2013	2014		
[Ilot des Trois Bergers 5m vs. 15m]					

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Ilot des Trois Bergers, 15m depth



Publications

Derniers articles publiés

- ▶ Diaporama PROTEKER 1 (dec. 2011 - jan. 2012)
- ▶ Diaporama PROTEKER 2 (nov.-dec. 2013)
- ▶ Diaporama PROTEKER 4 (nov. - dec. 2015)
- ▶ pour voir la rubrique
- ▶ Iles du Prince de Monaco, 5m depth
- ▶ Iles du Prince de Monaco; 15m depth
- ▶ Iles du Prince de Monaco, 5m vs. 15m depth
- ▶ Fjord des Portes Noires, 15m depth
- ▶ Fjord des Portes Noires, 5m depth
- ▶ Fjord des Portes Noires, 5m vs. 15m depth
- ▶ Ilot des Trois Bergers, 5m vs. 15m depth
- ▶ Ilot des Trois Bergers, 15m depth

Statistics

Latest update
Saturday 16 April 2016

Publishing
58 Articles
Aucun album photo
No news item
No site
2 Authors

Visits
34 today
78 yesterday

PROTEKER, IPEV program
1044 - Summer field
campaigns

Partners and participants

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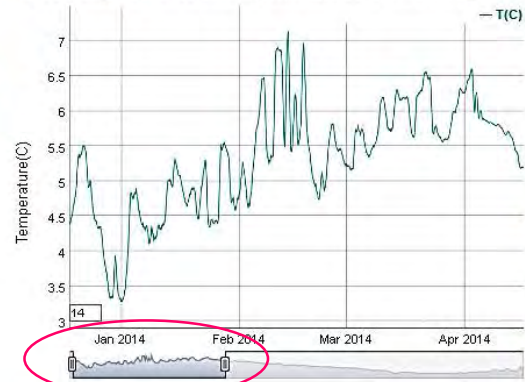
Jean-Pierre FERAL

lîlot des Trois Bergers, 15m depth

Tuesday 12 January 2016
by Jean-Pierre FERAL
popularity : 11 %

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Sea water temperature from December 15, 2013 to December 5, 2014 at 15m depth



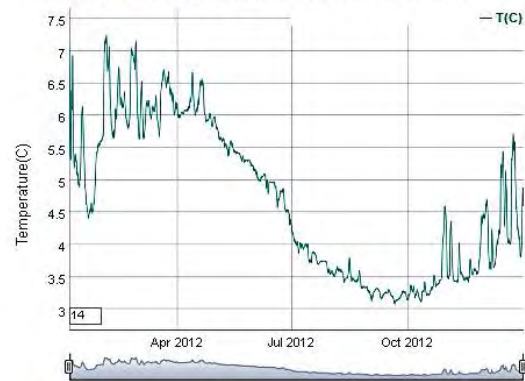
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Sea water temperature from January 1, 2013 to December 1, 2013 at 15m depth



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Sea water temperature from January 6, 2012 to December 31, 2012 at 15m depth



Publications

Derniers articles publiés

- Diaporama PROTEKER 1 (dec. 2011 - jan. 2012)
- Diaporama PROTEKER 2 (nov.-dec. 2013)
- Diaporama PROTEKER 4 (nov.-dec. 2013)
- pour voir la rubrique
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- lîlot du Prince de Monaco, 15m depth
- lîlot du Prince de Monaco, 5m vs. 15m depth
- Fjord des Portes Noires, 15m depth
- Fjord des Portes Noires, 5m depth
- Fjord des Portes Noires, 5m vs. 15m depth
- lîlot des Trois Bergers, 5m vs. 15m depth
- lîlot des Trois Bergers, 15m depth

Navigation

in the same section...

- lîlot des Trois Bergers, 5m depth
- lîlot des Trois Bergers, 15m depth
- lîlot des Trois Bergers, 5m vs. 15m depth

Statistics

Latest update

Saturday 16 April 2016

Publishing

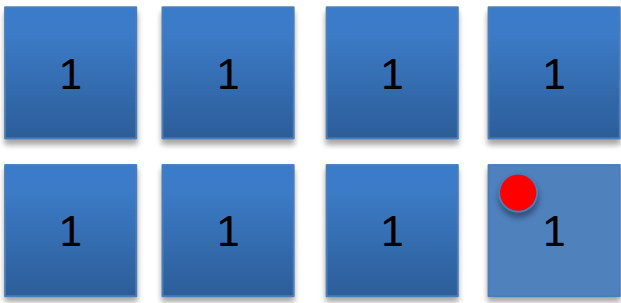
58 Articles
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Visits

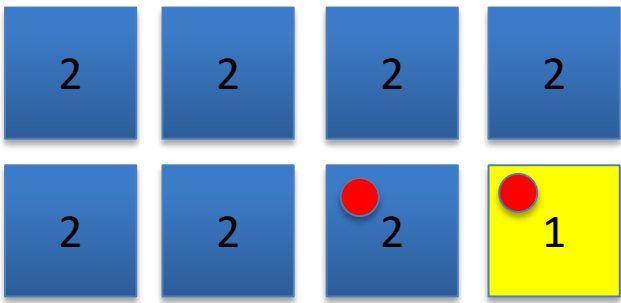
34 today
78 yesterday
65649 from the beginning
2 visiteurs actuellement connectés

Settlement plots

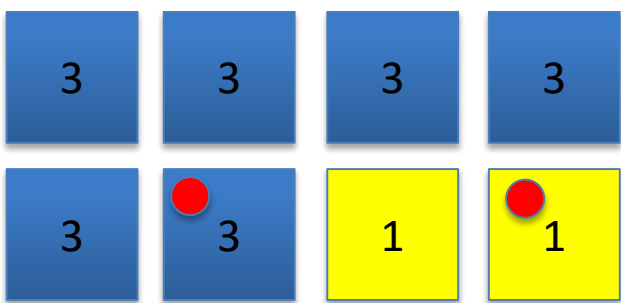




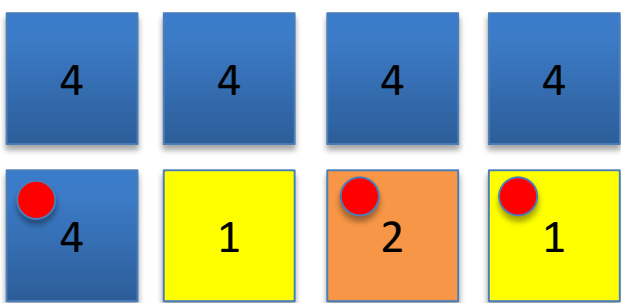
A₁



A₂

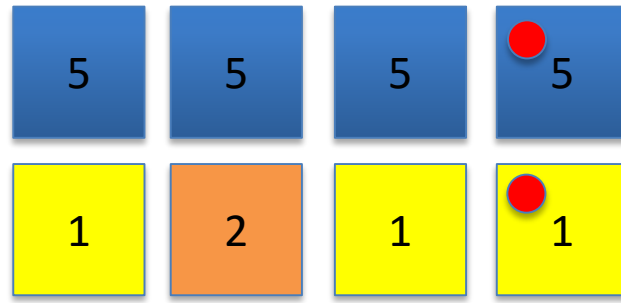


A₃

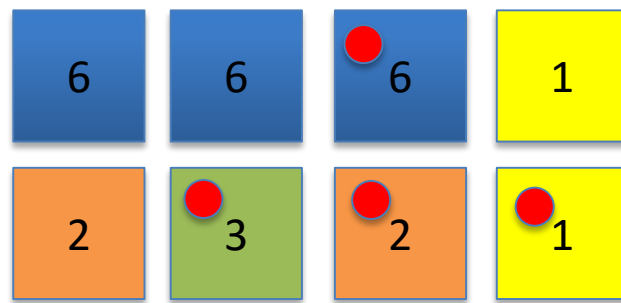


A₄

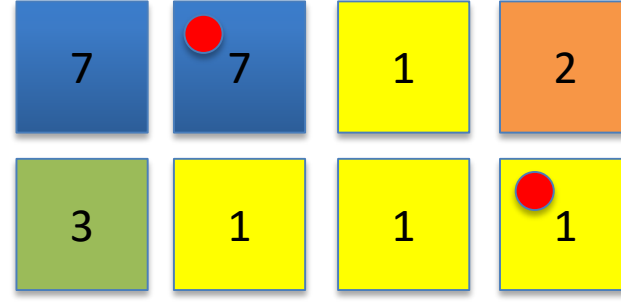
Settlement plots protocol



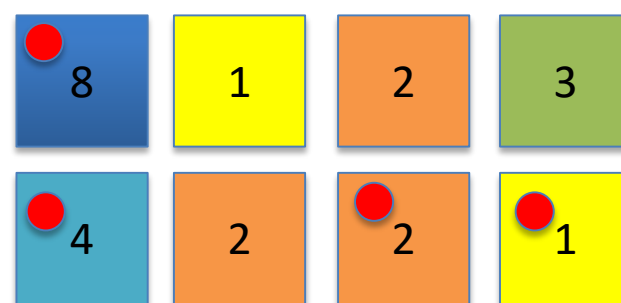
A₅



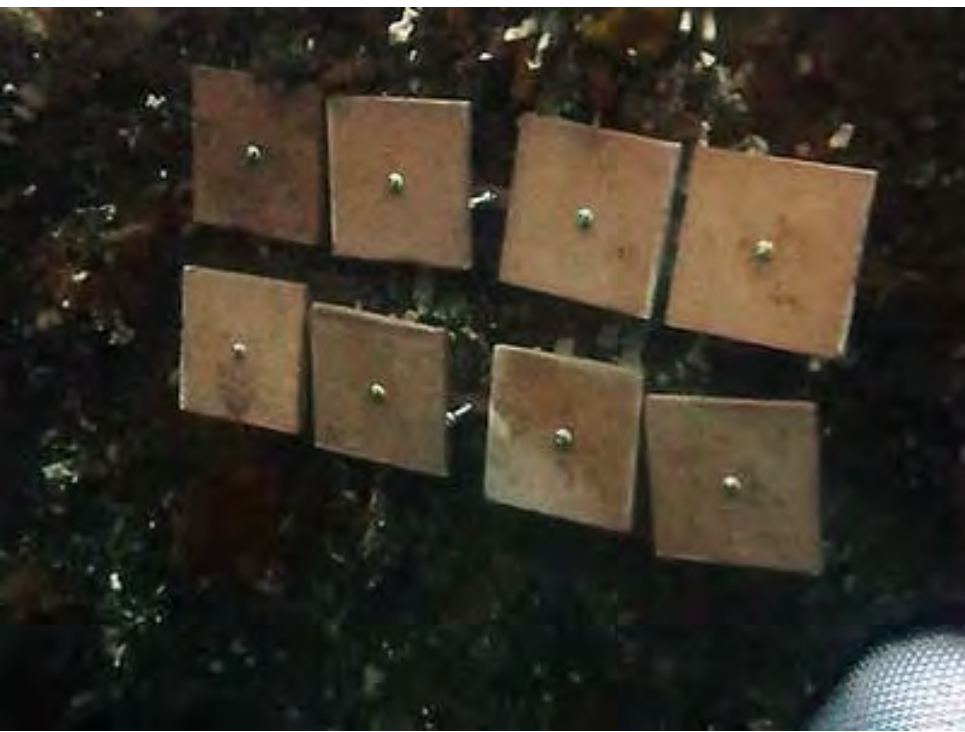
A₆



A₇

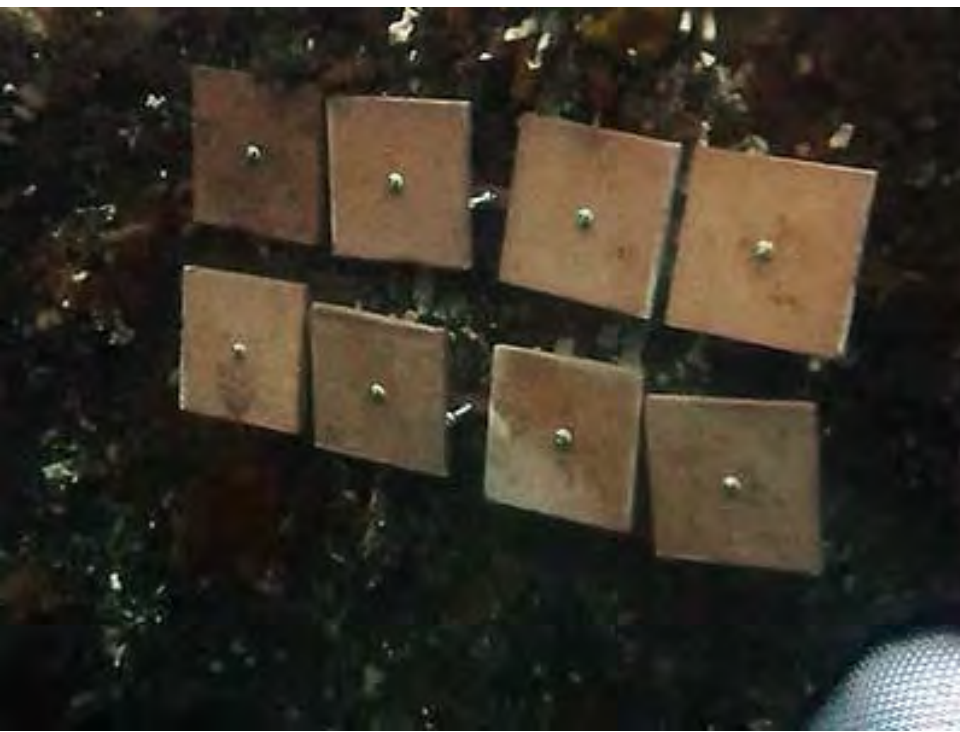


A₈



Ile Suhm, december 2013



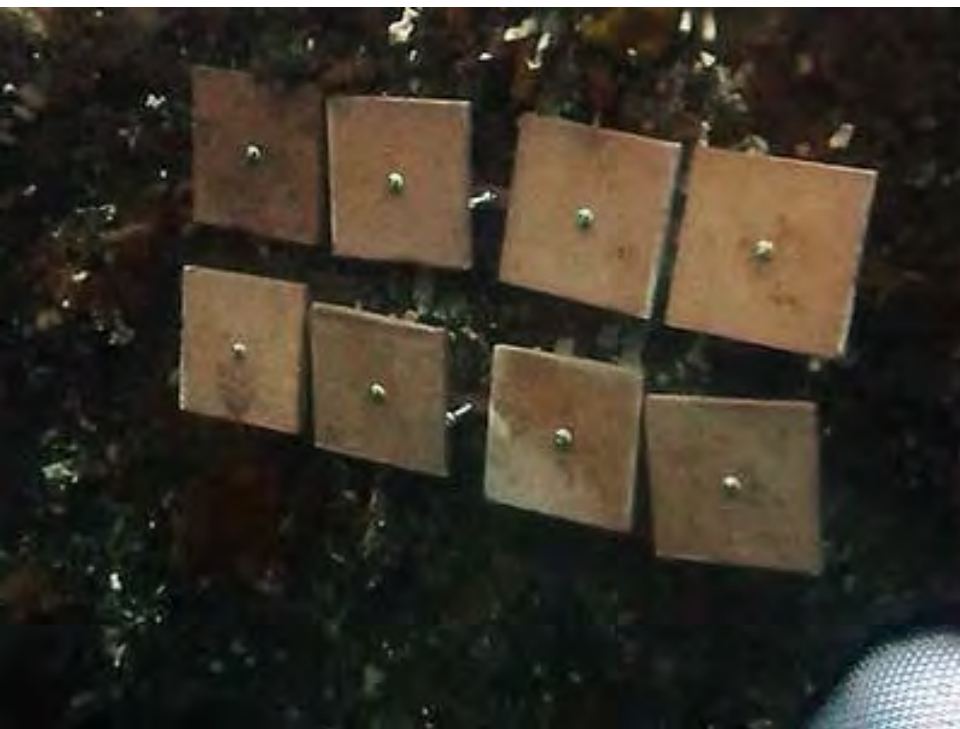


Ile Suhm, december 2013



Ile Suhm, december 2014

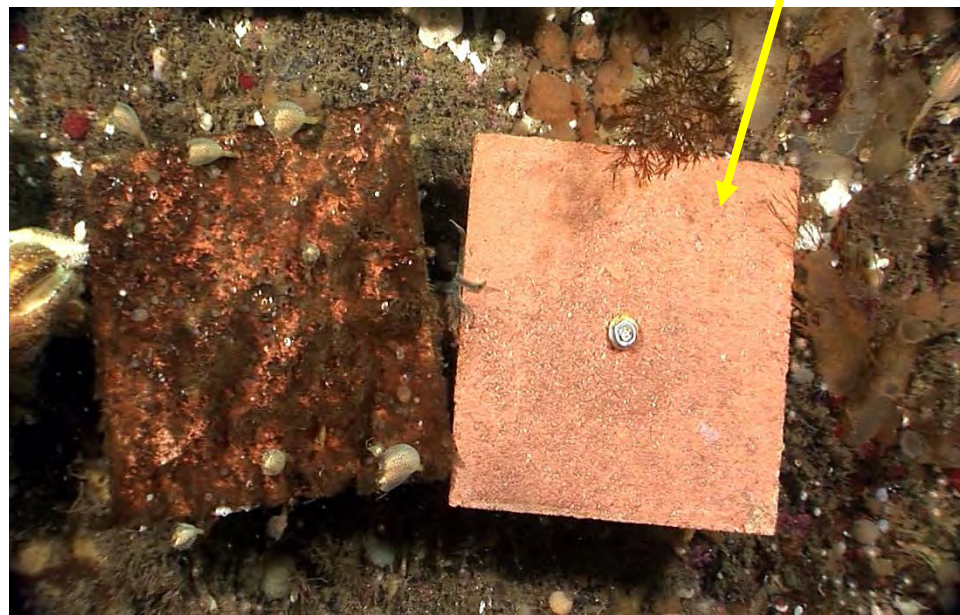




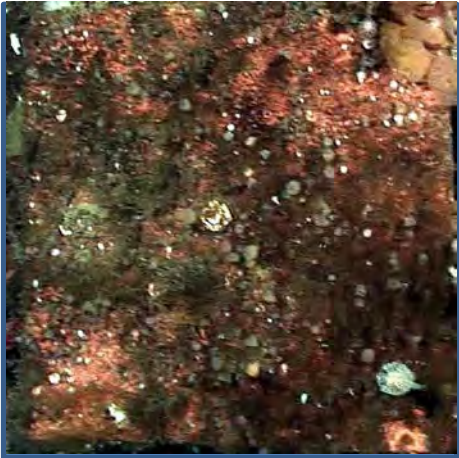
Ile Suhm, december 2013



Ile Suhm, december 2014



A



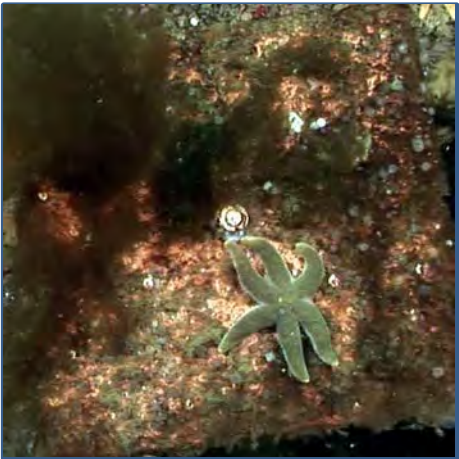
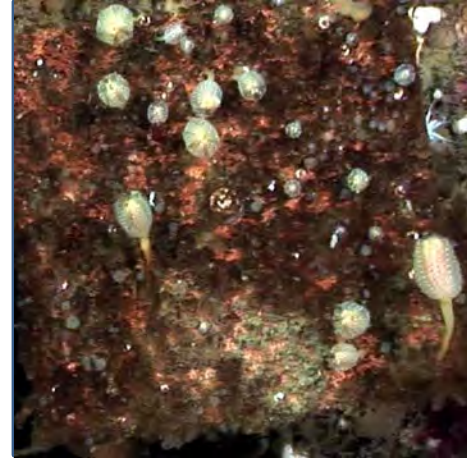
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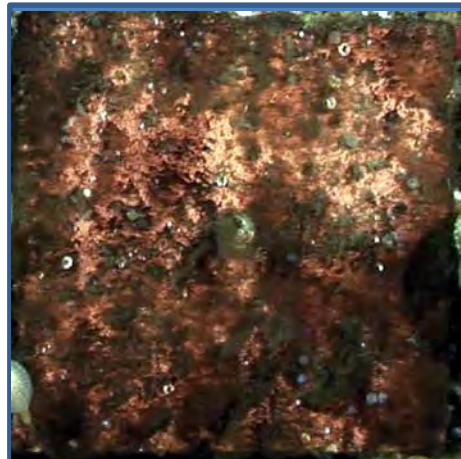
C



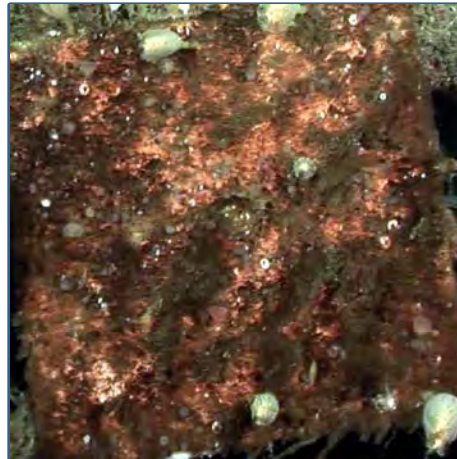
D



E



F

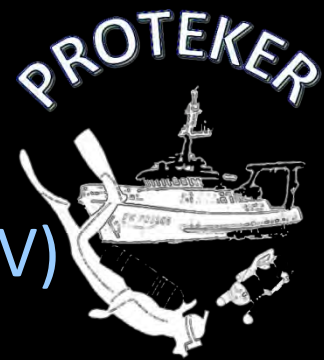


G



H

Ile Suhm, december 2014



- To choose relevant sites
- To upgrade inventories (diving, towed gears, ROV)
 - guides (photos, video)
 - illustrated data bases (indexing, cataloguing, inter-operability, contextualization, traceability , international systems)
- To setup sensors
- To estimate speed and quality of colonisation / recruitment (settlement plots)
- To choose model species with large distribution area or endemic (population genetics, phylogeography → *connectivity, self recruitment*)
- To contribute to the necessary scientific bases to write a management plan of the coastal marine domain

Valuation

Model species
· *Abatus cordatus*.
· *Mytilus edulis*



Collaboration with Chile

Collaboration with labs of l'université de la Réunion and l'Institut de Chimie des Substances Naturelles du CNRS de Gif-sur-Yvette (active substances from Porifera)



Trophic webs (isotopic analyses)



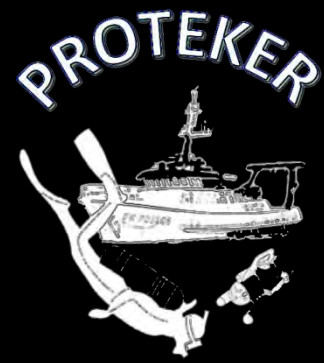
First ROV exploration of île Amsterdam

Training of staff from the Nature Reserve



Phase 2

The overall scope of the project will depend on the support vessel availability (*La Curieuse* or equivalent)



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- At least the monitoring of the Baie du Morbihan [4 sites] will be ensured (small vessels such as *Le Commerson*)
- External (north and south) sites will depend on the route and schedule of the research and supply vessel *Marion Dufresne 2*



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In any case, the next step will be to adapt monitoring protocol produced by coastal research programs

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- External (north and south) ... the route
and schedule of the ... Marion
Dufresne 2

In any case, the ... adapt monitoring
protocol produced ... research programs

Late Breaking News
La Curieuse will be in
Kerguelen next
(austral) summer !!

La Curieuse, Kerguelen,
PROTEKER 1 2011-12



La Curieuse, Kerguelen,
PROTEKER 2 2013



La Curieuse, Kerguelen,
PROTEKER 3 2014



Thank you for attention

Scientific divers:

- Jean-Pierre Beurrier [1]
- Jean-Pierre Féral [1, 2, 3]
- Christian Marschal [1, 2, 3]
- Gilles Marty [2, 3]
- Sébastien Motreuil [3]
- Elie Poulin [2]
- Jean-Claude Roca [1, 3]
- Thomas Saucède [2]

Crew of La Curieuse for the 3 campaigns:

- Baptiste Aspa (chief engineer) [1]
- Vincent Benard (mechanic trainee) [3]
- Mathias Cadet (mechanic trainee) [2]
- Benoît Caffier (cook/deckhand) [1, 2, 3]
- Laurent Conillen (first mate) [1]
- Alix Daujat** (capitain) [1]
- Corentin Hemmer (2nd engineer) [3]
- Sébastien Laffont (deckhand) [3]
- Pierre-Yves Le Bren (chief engineer) [2]
- Arnaud Michelot (chief engineer) [3]
- Yohann Mucherie** (capitain) [2, 3]
- Jimmy Payet (deckhand) [1]
- Xavier Payet (deckhand) [2]
- Yann Rivière (mechanic trainee) [1]
- Anthony Sautron (2nd engineer) [1, 2]
- Pierre Samuel (first mate) [3]
- Loïc Guigneau (first mate) [2]
- Romain Vergé (skipper of *Le Commerson*) [3]



An underwater photograph showing a dense field of seaweed with long, dark, ribbed blades. The water is a deep blue, and sunlight filters through from above, creating a shimmering effect. In the lower right corner, there is a patch of reddish-brown coral or other marine life.

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Merci de
votre
attention